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SOME POINTS IN THE ANATOMY OF THE HUMAN
TEMPORAL BONE.

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I.—THE WEIGHT AND DENSITY OF THE TEMPORAL BONE.

The weight of the bones of the skull in both sexes is greatest from twenty to forty-five, according to Gurriere and Massetti, 1895. Hence the maximum weight of 63.5 grams found in No. 119, among one hundred cleaned, dried temporal bones, probably approaches the maximum weight of the dry disarticulated adult bone quite closely. The lightest adult bone, No. 133 of this series, weighed but 22.5 grams, giving a difference of 41 grams.

Specimen 119 displaced 43 grams of water, its density hence being 1.48, but specimen 133 displaced but 10.5 grams of water, indicating a density of 2.14. Hence the lighter bone apparently had a far greater density. But the weight and density of bones, even when dried by years of exposure in a dry atmosphere, depends upon a great number of factors. One

must consider the age and possibly racial characteristics of the individual bone and especially the method and the extent of the cleaning. Hence for this and other reasons the results obtained from these two specimens probably are only roughly indicative of the true density.

The average weight of fifty intact right temporal bones in Table I, regardless of sex and including the ear ossicles and the styloid and zygomatic processes to the point of articulation of the latter, in the dried state is 41.5 grams. Fifty left temporal bones average 41.6 grams. Hence asymmetry in form, even though present to a marked degree as described by Cheatele in 1913, in certain skulls, does not give one side a preponderance in average weight, even if one takes only a relatively small number of temporal bones.

TABLE I.

Right Side		Left Side	
No. of Specimen	Weight	No. of Specimen	Weight
1	39 grs.	7	52 grs.
44	47 "	15	29 "
10	48 "	18	31 "
16	52 "	44	47 "
19	27 "	45	47 "
22	46 "	55	47 "
24	57 "	60	38 "
25	51 "	63	34 "
27	33 "	71	43 "
32	53 "	75	51 "
38	34 "	76	43 "
40	32 "	79	49 "
49	49 "	80	53 "
51	36 "	85	37 "
52	30 "	92	43 "
58	61 "	94	31 "
59	48 "	109	35 "
64	30 "	116	37 "
65	39 "	119	63 "
66	43 "	120	48 "
68	38 "	121	47 "

TABLE I.—Continued.

Right Side		Left Side	
No. of Specimen	Weight	No. of Specimen	Weight
69	52 "	130	52 "
70	62 "	145	50 "
105	47 "	146	47 "
106	32 "	148	42.5 "
107	37 "	153	38 "
108	30 "	156	25 "
114	52 "	157	36 "
115	39 "	163	27 "
122	35 "	166	31 "
124	27.5 "	167	36.5 "
125	37 "	168	36.5 "
131	36 "	323	43 "
133	22 "	325	38 "
134	31 "	327	38 "
142	46 "	328	34 "
147	57 "	333	38 "
152	35.4 "	341	47 "
154	38 "	345	33 "
164	37 "	347	36 "
322	39 "	349	40 "
326	32 "	352	49 "
329	50 "	353	40 "
331	52 "	357	44 "
335	40 "	359	30 "
340	50 "	361	48 "
342	48 "	364	36 "
343	40 "	369	40 "
344	41 "	372	55 "
348	32 "	373	59 "
Average wt., 41.5 "		Average wt., 41.6 "	

II.—TORSION OF THE PETROUS PORTION.

As is well known, the temporal bone represents three elements—the petrosal, squamous and tympanic elements—which usually can be separated at birth. The external acoustic

canal is largely unformed. At this time the tympanic ring is circular in outline and the tympanic membrane directly continuous and lies in the same plane as the external surface of the squamosa. Canal formation begins by the rapid growth of the anterior and posterior margins of the tympanic element, which are much thicker than the rest of the tympanic portion of the canal at this time. In adult bones, as we shall see later in the discussion of the osseous external acoustic orifice, we sometimes find a thickening at these very points, although this border usually becomes very thin in the adult condition.

At birth the petrous portion seems to show no torsion. In cross section it assumes the shape of an isosceles triangle—the anterior superior and the posterior superior surfaces forming straight sides. The inferior surface is quite irregular due to its articular surfaces, to the numerous foraminæ and the jugular fossa. The superior angle of the triangle is slightly rounded.

In the adult bone certain changes have occurred in the contour of the petrous portion. The medial extremity which articulates with the basilar portion of the sphenoid is directed anteriorly. This gives the superior border of the petrous bone a slightly bent direction, because it remains in juxtaposition with the sphenoid. But the superior margin, viewed from a median plane, also is rotated, anteriorally or clockwise, looking medially. The change that has taken place during this period of torsion has modified somewhat the structures underlying and contained within this portion of the bone, which forms the superior surface of the external auditory canal and envelops a part of the tympanum. The torsion which modifies the petrous portion modifies the form of the canal, as we shall see also, that of its external orifice.

In calculating the amount of rotation that the medial portion of the petroum element makes, I used the styloid process to fix the bone. It is impossible to determine the angle that the petrous portion makes with the styloid process in the newborn, on account of the absence of the process, but in the adult bones this process, when intact, is usually very definite and constant in direction.

The method used in calculating the angle of torsion is as follows: The bone was fixed by placing the styloid process

in a vertical position in a board with vertical holes graded as to size. The processes which are of variable size were fitted very snugly into suitable holes. In this manner, one can eliminate error to a great degree and can be relatively sure that all angles are measured from a fairly definite base line. The surface of the board is at right angles to the process, and the superior margin of the petrous portion is adjusted parallel to the edge of the board. By using the plane surface of the board as a base line, one can measure the angle of rotation of the petrous portion quite accurately with a protractor. In order to reduce error to a minimum, the angle of rotation was measured on a line passing through the center of the orifice of the internal auditory canal. This surface of the bone sometimes is irregular, due to a ridge just over this orifice. In these cases the arm of the protractor was placed as nearly parallel to the entire surface as possible. Such a procedure was rarely necessary, however, for usually the arm of the protractor could be rested on the side of the petrous bone, placed parallel to the surface with little difficulty and the angle read.

TABLE II.

Specimen No.	Angle of Rota'n	Specimen No.	Angle of Rota'n
3	118°	122	117°
7	113°	126	105°
16	117°	127	118°
17	113°	131	116°
20	118°	134	110°
22	116°	139	115°
24	122°	145	119°
28	116°	149	115°
31	114°	154	113°
35	125°	159	114°
46	115°	163	113°
59	115°	166	120°
65	113°	170	114°
66	112°	322	115°
67	116°	343	112°
75	117°	345	115°
76	115°	346	113°

TABLE II.—Continued.

Specimen No.	Angle of Rota'n	Specimen No.	Angle of Rota'n
78	122°	354	121°
82	115°	355	117°
89	112°	359	113°
93	121°	365	114°
117	118°	369	116°
118	120°	374	114°
120	113°	1169	112°
121	113°	1350	120°

It was interesting to find that there is a correlation between the angle of rotation of the petrous portion, measured as above, and the direction of the long diameter of the osseous external auditory orifice. When the long axis of the external orifice approaches a vertical plane—that is, when it is almost parallel to the styloid process, the anterior superior surface as measured above makes an angle of approximately 120° with the plane surface of the board. In specimens with the long axis approaching a horizontal position, the anterior superior surface makes an angle of approximately 110° with the plane surface of the board. In by far the commonest form, the long axis lies between the two extremes, the angle being about 115°. An average of the fifty specimens in Table II, calculated by this method, gave an angle of 115.7°. The maximum amount of rotation as measured above was 20°, which is the difference between 105° in specimen No. 126 and 125° in specimen No. 24. As the accompanying photographs show, one can determine the amount of rotation of the petrous portion with considerable accuracy by noticing the direction of the long diameter of the osseous external acoustic orifice. Furthermore, if the styloid processes of any series are placed parallel and opposite, the lines indicating the direction of the long diameter of the external orifice will be parallel.

Specimen 149, Fig. 1, the opposite surface of which is represented in Fig. 2, illustrates the usual condition of rotation. In specimen No. 126, represented in Figs. 3 and 4, the direction of the string or the long diameter of the external acoustic orifice is almost parallel to the styloid process, thus repre-

senting a totally different angle of rotation. In specimen No. 24, represented in Figs. 5 and 6, on the other hand, the direction of the long diameter of the external acoustic foramen forms almost a right angle with the styloid process.

There are numerous factors to be considered as to the cause of this rotation, which is always in the same direction—the superior margin being directed anteriorly, but it occurs after birth. At birth and shortly afterwards, no torsion was observed in looking over 125 fetal and infantile specimens. It will be recalled that the basilar portions of the occipital bone also is more vertical and only slightly grooved at this period, the deep hollowing found in adult bones apparently being coincidental with the torsion of the petrous element.

By the sixth month of fetal life, the skull, though smaller, is in much the same condition as at birth, except that the occipital region is relatively larger. The most striking differences are the insignificance of the facial portion and the flatness of the base. In the cranium the frontal region is relatively small. According to Dwight, '07, Merkel divided the growth of the head into two periods, with an intervening one of rest. The first period ends with the seventh year and is followed by inactivity till puberty, when the second period begins. Our interest lies in Merkel's first two stages of the first period, which are said to end at the fifth year. In the first stage, reaching to the end of the first year, the growth is general, but the face gains on the cranium. At six months the basilar process rises more sharply, which, with the downward growth of the face, may have an important effect on the torsion of the temporal bone, since the greatest degree of rotation occurs at this time. In the second stage, to the end of the fifth year, the vault grows more than the base, assuming a more rounded and finished appearance. The face still gains relatively, but grows more in breadth than in height. It is quite probable from my observation that with the termination of this period the maximum degree of torsion has been attained.

As stated above, the torsion begins after birth and apparently continues quite rapidly, for as far as I could observe, in specimens a few years old, the maximum amount of torsion

already had been reached. Hence torsion occurs during infancy at a time the brain grows most rapidly. We have a rapidly growing brain and growing bones which envelop it. We also know that the brain molds the skull to a certain extent and that the skull also modifies the shape of the brain. Since these two conditions appear at the same period in development, the brain factor may have a great deal to do with these modifications of the petrous element at this time. It is possible that the cerebellum and the medulla oblongata exert a pressure by their rapid growth, forcing the basilar portion of the sphenoid and the superior margin of the petrous portion of the temporal bone anteriorly, thus accelerating the growth of the anterior portion of the skull which responds to the marked development of the frontal lobes.

The rapid growth of the cerebrum after birth also may exert a pull upon the dura at its close attachment to the superior margin of the petrous portion of the temporal bone, thus deflecting the medial extremity forward. Not only is the direction of this portion changed during this period, but the superior margin is molded somewhat, for this border is sharper in the adult form than it is in the infantile condition.

III.—THE ANGLE BETWEEN THE PETROSA AND SQUAMOSA.

The angle that the superior margin of the petrous portion makes with a tangent parallel in the main, with the squamosa also, is greater in the adult condition than it is in the newborn. The squamous portion of the temporal bone has the general direction of the lateral surface of the calvarium—the squamosa itself occupying about one-half of the lateral surface in length. The suture between the parietal and temporal bone immediately over the mastoid process is generally very low, and one can readily measure the angle that the petrous element makes with the squamosal by means of a protractor, upon disarticulated bones. Using the external surface of the squamosa immediately above the posterior root of the process as a base line for one arm of the protractor, the angle which the petrous element makes with this arm can be measured directly.

About the time of birth there apparently is a very slight variation in the angle. It varied from 66 to 70 degrees in a

small series of 20 infantile and newly born temporal bones. In the adult condition there is a greater variation, however, for an angle of 52 degrees was found as a minimum and one of 64 degrees as a maximum. The average of the angles between the petrous and squamous portions in 50 specimens in Table III is 57.2 degrees.

TABLE III.

No. of Specimen	Angle	No. of Specimen	Angle
1	59	35	56
2	53	39	53
3	55	40	60
4	60	42	58
6	60	43	58
7	52	44	60
9	55	45	60
14	54	46	64
15	58	47	60
16	58	48	56
17	55	49	60
18	60	51	58
20	55	53	58
21	58	56	60
22	59	58	60
23	58	61	55
24	56	71	60
25	53	152	55
26	60	159	55
27	60	321	62
28	60	326	61
29	60	341	56
30	60	374	57
31	57	1114	55
34	56	1168	58

IV.—VARIATIONS IN THE MASTOID FORAMEN.

The mastoid foramen, when present, has a greater uniformity in position than one infers from a textbook description. Piersol, 1907, gives a typical description in saying that a

small canal, the mastoid foramen, transmitting a vein, runs from the sinus to the outside of the bone, and sometimes reaches as far back as the suture between the temporal and the occipital. Cheatle, 1906, described the vein as leaving the lateral sinus in its descending part and usually running upwards, backwards and outwards with a curved course, to emerge at the posterior edge of the base of the mastoid process. I believe it would be more nearly correct to limit the area of emergence, for after looking over more than 250 adult temporal bones I find that it usually emerges directly over the digastric groove, on a level with the upper margin of the osseus external acoustic orifice. When the lambdoidal suture at its lower extremity forms a convex surface on the mastoid portion of the temporal bone, the foramen is found slightly medial to the digastric groove. If the lambdoidal suture is straight at this region, which is the more common form, the foramen may even appear in the suture, or within a centimeter of the suture, thus appearing directly above the digastric groove. It would appear from this that the suture between the temporal and the occipital bones had a great deal to do with determining the position of the foramen. One very rarely finds the foramen lateral to the digastric groove.

By tabulating the occurrence of the common forms of canal, we find some interesting data, as judged by 250 specimens in Table 4, chosen at random from our collection. In 68 specimens, or 27 per cent of the bones, there was no indication of a canal from the lateral sinus to the outside of the bone. One can always find emissary foraminae, variable in number and size, over the mastoid process and at its base, but I do not include any canals that cannot be traced to the lateral sinus. It also is relatively common to find a canal apparently for a vein, entering and leaving on the lateral surface of the base of the process without penetrating deeply into the bone.

In 167 specimens, or 67 per cent of the 250 bones, the canal is single and usually can be traced with very little difficulty from the sinus to the outside of the bone. It is common to find one opening of the canal on the inner table, which divides within the spongiosa and emerges by two openings. This was observed in 11 specimens, or 4 per cent. Four specimens had two separate canals traceable from the sinus to the outside.

In one case the canals were fully two centimeters apart, and both appeared above the digastric groove, being due to two separate veins leaving the lateral sinus.

When the foramen divides within the diplœ to emerge as two canals, one finds them emerging almost parallel. In a few cases, the canal is directed straight out from the lateral sinus, and the distance between the lateral sinus and the external surface of the bone is no greater than the thickness of the bone.

Cheatle, 1906, in discussing the size of the canal described it as being as "big as a pencil" in some cases, and so small that it would not admit a pin in others. Myer, 1913, reported an abnormally large unilateral foramen mastoideum with a diameter of 6 mm. on the inner surface, and a sulcus emissarium on the exterior with an oval mouth with a long diameter of 8 mm. In the 1500 adult temporal bones examined I found none with an abnormally large canal, thus indicating that large canals are very uncommon.

TABLE IV.

	No.	Per Cent.
Absence of emissary canal.....	68	27
Single emissary canal.....	167	67
Bifurcating emissary canals.....	11	4.4
Double canals.....	4	1.6
Total.....	250	100

V.—THE PROCESSES IN THE MASTOID REGION.

The pars mastoidea, which forms the posterior part of the temporal bone, is continued below into a conical projection, the mastoid process, the size and form of which varies somewhat and which is said to be larger in the male than in the female. The mastoid process is relatively small at birth and contains no air cells except at the antrum. It becomes distinct about the first year, coincident with the obliteration of the petrosquamous suture. The suture is frequently found not wholly fused in the adult temporal bone. Toward puberty

the process becomes pneumatic. This process, which serves for the attachment of the sternocleidomastoideus, splenius capitis and the longissimus capitis muscles, is sometimes divided by a deep groove, the digastric, for the attachment of the posterior belly of the digastricus. Just medial to this groove is a small shallow furrow which lodges the occipital artery.

So much diversity of opinion exists among authorities as to the correct names of the processes of the mastoid region that one is hardly safe in describing this region without first referring to matters of terminology. Gray, 1905 edition, makes no reference to paramastoid or paroccipital processes in man, but in the edition revised by Lewis, 1913, the paramastoid is described in connection with the occipital bone, as an eminence which sometimes projects downwards from the rough under surface of the jugular process, where the rectus capitis lateralis muscle and the lateral atlantooccipital ligament are attached. It is stated that this eminence may be of sufficient length to reach and articulate with the transverse process of the atlas. The last edition of Gray does not mention the par-occipital process, and neither Piersol, 1907, nor Allen, 1884, describe either process. Morris, 1899, says that a process of bone projects rarely from the under surface of the quadrilateral shaped jugular process "homologous to the par-occipital process present in many animals." Thomson, 1917, also described a rough or smooth elevated surface, or else a projecting process springing from the under surface of the extremity of the jugular process, the extremity of which may articulate with the transverse process of the atlas. When this process is met with, he terms it paramastoid or paroccipital. According to Corner, 1896, Macalister, regarded the jugular process and its extension as the paramastoid or par-occipital. Bryce, 1914, described a distinct ridge occurring normally on the medial lip of the groove for the digastric muscle, which may be developed into a process of considerable dimensions and may even be rendered bullous by containing an air cell. This process he calls paramastoid. The term par-occipital is not mentioned in this text.

Corner, 1896, examined 304 mastoid processes and called attention to the existence of a process of the temporal bone

on the inner side of the digastric groove which was present in some form in 93 per cent of the specimens he examined. He also found a similar crest, ridge or process present on the temporal bones of 20 monkeys and in the skulls of 3 lemurs. He proposed in the consideration of the constant presence of this process, that the name "par-occipital" should be confined to the downward expansions of the occipital bones, and the name "paramastoid" should be applied to the process at the inner lip of the digastric groove.

Waldeyer, 1909, in discussing processes of this region, wrote that "Der Processus retromastoideus ist diejenige Bildung, welche mich zu einer erneuten Untersuchung der Regio occipitalis und mastoidea des menschlichen Schädels veranlasst hat und den Kernpunkt dieser Abhandlung darstellt." He added that the retromastoid process is "einen meist stumpfen, bald mehr rundlichen, bald mehr länglichen Fortsatz von durchschnittlich 0.5 bis 2 cm. Höhe, der sich an der Stelle des Zusammenstosses des oberen queren Nebenschenkels der Linea nuchæ inferior mit der Linea semicircularis superior entwickelt."

Other processes also have been described in this region. Waldeyer, 1909, stated that von Haferland described a rounded process which develops on both sides from the angulus mastoideus of the parietal and which projects laterally directly above the parietomastoid suture. Von Haferland termed this projection the processus astericus, but Waldeyer preferred the designation tuberculous supramastoideum posterius.

Since the prefix *para* means beside, beyond, accessory to, apart from, and against, the paramastoid process should by definition be near the mastoid process. When one examines this region in a series of temporal bones, one can find the mastoid process with the digastric groove in all degrees of depth—from a mere slight sulcus in cases in which the process shows no indication of division, to that of a deep groove a centimeter or even more in depth, where the process is well divided. This seems to indicate that this process, though frequently divided by a deep groove, is in reality one and the same process developmentally. Hence it would seem that when the

process is bifid due to the presence of a deep digastric groove, the outer portion should preferably be called the lateral and the other the medial portion of the mastoid process. And in cases where there are two grooves, as described later, the terms lateral, intermediate and medial could be used.

In Table 5, 500 adult temporal bones showing indications of a mastoid-occipital suture are classified with reference to the appearance of the medial portion of the mastoid process. The lateral portion of the mastoid process is present in all. Specimen 32 has a definite retromastoid process, and in three others it was indicated. In 37 cases two grooves were observed, one the digastric and the other the occipital, thus splitting the mastoid process into three portions with the presence of an intervening ridge or tubercle.

It is stated that in rare cases the extremity of this process may articulate with the transverse process of the atlas. The corresponding atlas is not present in our collection, but the length of the jugular process is such that this could well have been the case in this specimen, although its character suggests that this was not so.

The triplicate condition or that in which the medial portion of the mastoid process is divided, may be confined entirely to the temporal bone; or as in Figure 7, it may be more extensive, occupying the adjacent lateral portion of the occipital. In this particular case the medial portion of the mastoid process exists as two marked ridges. The jugular process articulated with a superior articular process of the atlas obliterating the jugular notch entirely, the condyloid and jugular processes being continuous.

Fig. 8 shows an abnormally large jugular process, more than 1 cm. in length, extending from the quadrilateral shaped space on the under surface of the occipital bone. This process has been described by Thomson, 1917, and by others.

Other conditions within the process also may be of unusual interest. Fig. 9 shows a single large mastoid cell, more than 1 cm. in diameter, occupying the medial portion of the mastoid process, while another cell, Fig. 10, same specimen, occupies the entire lateral portion of the process. This latter cell was $1\frac{1}{2}$ cm. in length, 1 cm. wide and 1 cm. in depth.

TABLE V.

Character of the portion of the mastoid process medial to the digastric groove in 500 specimens:

Ill defined or absent.....	118	23.6%
Bullous	69	13.8%
Short crest	79	15.8%
Long crest	107	21.4%
Rough irregular prominence.....	21	4.2%
Tubercle	65	13. %
Divided (by occipital groove)	37	7.4%
Retromastoid process (1 definite, 3 indicated)	4	0.8%
Total.....	500	100. %

THE OSSEOUS EXTERNAL ACOUSTIC MEATUS.

Of all the variable features of the normal temporal bone, the osseus meatus reveals the greatest number. One finds so many grades of variations in the size and contour that the determination of the normal form is quite difficult. Harrison Allen, 1884, in describing the relationship of the tympanic ring to the antrum, stated that "the curve of the U is much roughened and produced downwards." In Morris, 1899, it is stated that the external auditory meatus assumes the form of an elliptical bony tube. Toldt, 1908, depicted as typical an antrum nearly circular in outline. Cheattle, 1906, who wrote extensively on various aspects of the temporal bone, did not describe the form of the antrum. Thomson, 1917, in Robinson's Revision of Cunningham's Anatomy, fifth edition, described the meatus as oval in form with its long axis almost vertical near the orifice. Neither Piersol, 1907, nor Bryce, 1915, mention its form.

The specimens examined by me include all the above forms—from those almost round in appearance to those of an extremely oval type. The round forms are of various sizes, some measuring no more than 0.5 cm. in diameter at the orifice, although the maximum diameter at this point was 1.5 cm., a variation in size of 300 per cent. From the round form the picture changes by degrees to that of a decided

oval. All gradations in form can be seen, even if one observes only a relatively small number of bones. The shortest diameter of an oval form was 0.5 cm., and the longest, a little less than 2.0 cm. Between these figures one can find all possible forms and dimensions.

Oval forms were observed extending in a vertical plane, practically parallel to the styloid process. The opposite condition with the long axis in a horizontal plane and almost at angles to the styloid also was observed. Specimen 126, Fig. 4, illustrates the former condition, with the string over the long axis, and specimen 24, Fig. 5, approaches the opposite form. The intermediate form, which is the more common condition, is seen in Fig. 1, specimen 149. No form was observed in which the superior margin of an oval orifice lay posterior to a line drawn vertically through the center of the orifice of the meatus.

The size of an orifice may be greatly modified by exostoses. Cheattle, 1913, said that these always occur on the tympanic portion of the bone. Welcker, 1864, was one of the earliest anatomists to describe this form of exostosis. He found it far more common in skulls from American Indians than in any other race. Although exostosis had been observed by otologists in Europe at that time, their presence was regarded as quite rare. According to Welcker, 1864, who described three exostoses of the tympanic portion of the ring, Seligman had noted their presence in five out of six temporal bones from South American Indians.

An exostosis of the tympanic portion of the antrum may develop to a state of almost total occlusion of the meatus, as is seen in the accompanying photographs, Figs. 11 and 12, of an Indian skull found on Blaylock's Island, Columbia River, near Umatilla, Oregon. In the left meatus, Fig. 11, the extremities of the superior margin of the ring have become so thickened that they almost touch. Fig. 12 of the right meatus, shows a third somewhat smaller exostosis appearing at the inferior border of the ring, midway between two marginal thickenings. It is very doubtful whether a patent canal was present during life, for it probably was completely occluded by the exostoses with the overlying soft parts.

The failure of otologists and anatomists in general to record these exostoses would indicate that they are quite rare. Yet specimen 100, Fig. 13, has an exostosis present on the posterior margin—the anterior being normal. This, too, came from an Indian. But on looking over 75 more Indian skulls I failed to find another specimen with exostoses at these points.

Another structure which tends to diminish the size of the orifice is the postauditory tubercle which develops downwards from the superior margin of the external auditory orifice and may reach a goodly size. Although frequently absent, it may be modified and project outwards and downwards as a shelf or laminum. Specimen 1228, Fig. 14, presents such a case. In specimen 331, Fig. 15, this tubercle has a base of almost one centimeter, and is in the form of an equilateral triangle, the apex of which is directed downwards and slightly outwards.

The tympanic portion of the meatus may be generally thickened, even to one-half a centimeter, thus occupying some of the orifice, as the petrous portion is the denser bone of the two and yields least, hence diminishing the size of the orifice.

SOME POINTS IN THE ANATOMY OF THE HUMAN TEMPORAL BONE.

1. The average weight of 100 clean, dry, temporal bones was found to be 41.5 gms. and approximately the same on both sides.
2. The average angle between the superior margin of the petrous portion and the squamosa is 67.2° in the adult and 78° in the infant.
3. The angle between a horizontal and the posterior superior surface of the petrous portion varied between 105 and 125 degrees and coincided with the long diameter of the osseus external acoustic foramen.
4. A mastoid emissary canal was absent in 27 per cent of 250 specimens: was single in 67 per cent and quite variable in direction and number in 6 per cent. The external foramen usually is located above the digastric groove on a level with the upper margin of the osseus external acoustic orifice. Tubercles and exostosis were observed in the meatus.
5. In view of the present confusion in use of the terms paramastoid and par-occipital, it is suggested that we speak

of lateral and medial portions of the mastoid, and also in cases of triplicate division, of an intermediate portion, designating the other paramastoid processes as jugular and retromastoid.

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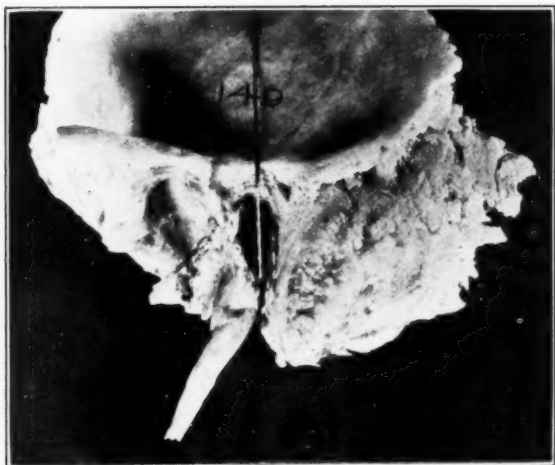


Fig. I. Specimen 149. Exemplifying the relation of the long axis of the external acoustic orifice to the styloid process, the usual condition.

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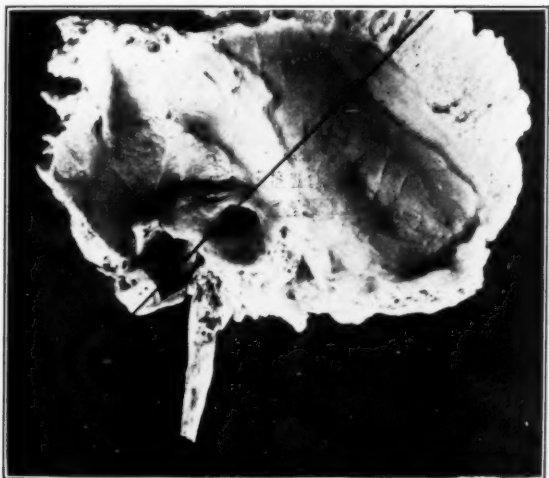


Fig. II. The same specimen, the string indicating the direction of the posterior superior surface of the petrosa, the usual condition.

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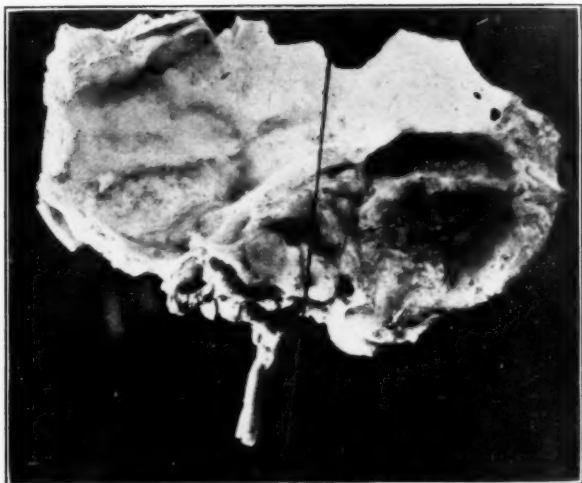


Fig. III. Specimen 126. Showing the direction of the posterior superior surface of petrosa almost parallel to styloid process.

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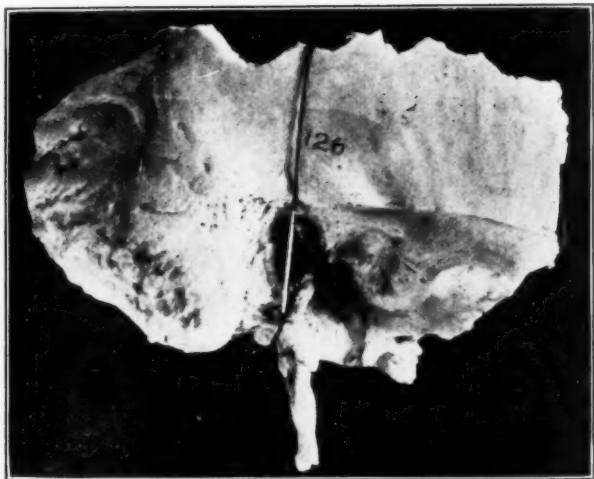


Fig. IV. The same specimen, showing the long axis of external acoustic orifice almost parallel to styloid process.

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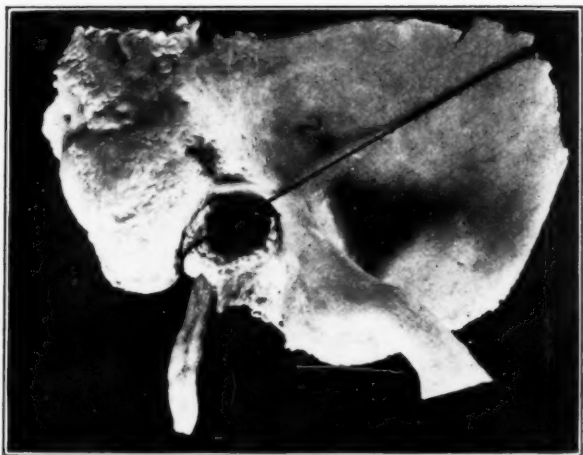


FIG. V. Specimen 24. The long diameter of meatus forms almost a right angle with styloid process.

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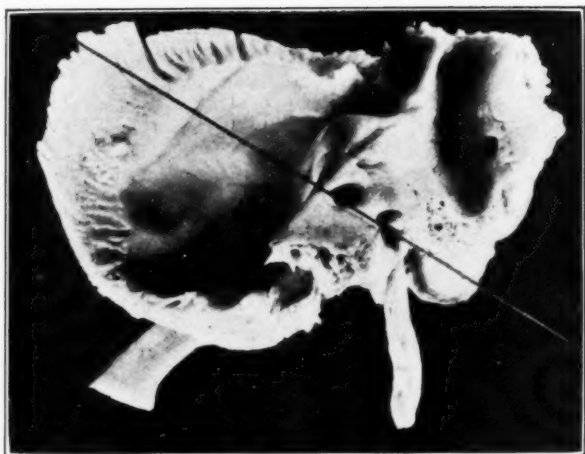


Fig. VI. The line across the posterior superior surface of petrosa forms almost a right angle with styloid process.

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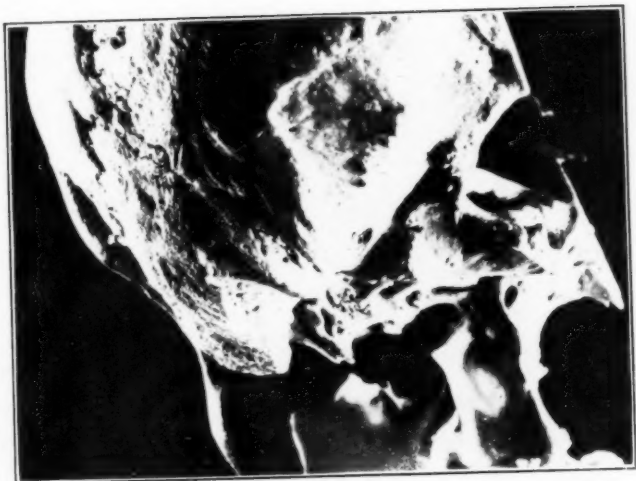


Fig. VII. Triplicate division of the left mastoid process.

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Fig. VIII. An abnormally large jugular process.

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Fig. IX. A single mastoid cell medial to the mastoid process.

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Fig. X. A single large air cell lateral to the mastoid process.

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Fig. XI. Marked exostoses of the tympanic element in a left external auditory orifice.

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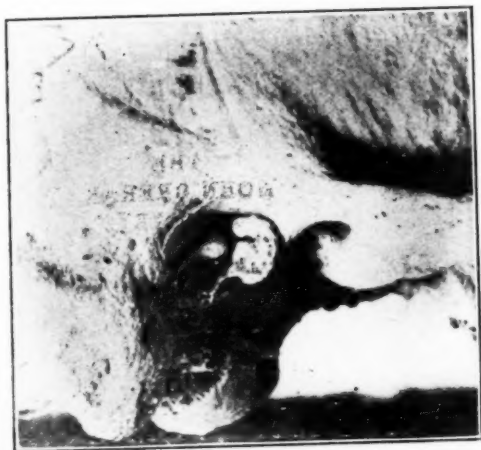


Fig. XII. Right meatus with three points of exostoses.

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Fig. XIII. Exostosis of the posterior portion of tympanum.

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Fig. XIV. A laminum projecting outwards and downwards from the superior margin of the external auditory orifice.

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Fig. XV. A large post-auditory tubercle.

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XVII.

THE ROENTGENOGRAPHIC STUDY OF THE ACCESSORY SINUSES WITH SPECIAL REFERENCE TO THE NEW TECHNIC FOR THE EXAMINATION OF THE SPHENOID SINUSES.*

BY GEORGE E. PEABLER, M. D.,
PHILADELPHIA.

The accessory sinuses are demonstrable by the Roentgen rays because they contain air and are surrounded by bony walls. They are, therefore, more transparent than the surrounding tissues. By means of the Roentgen rays one can demonstrate their size, outline, position and the condition of the walls and the septa. The sinuses on the two sides of the head can be projected in such manner that they can be used for direct comparison as to their transparency or density. In this connection it must be borne in mind that if the sinus on one side is smaller than that of the opposite side, it is normally less transparent and must, therefore, not be interpreted as being diseased.

Disease of the accessory sinuses may consist of exudate within the cavities, of tumor formation within the cavities, or of any of the bone diseases involving the bony walls. Exudate within the accessory sinuses causes a decrease in transparency. One cannot determine the nature of the exudate by the Roentgen rays, and we must expect mucus, pus or blood to cast similar shadows. If this exudate involves only the sinuses on one side, there will be shown a striking contrast when compared with the opposite side. If both sides are involved, as for example in the case of the maxillary sinuses, one would compare the transparency or opacity with the sphenoids and the frontals above. If all of the sinuses are diseased and filled with exudate, one must consider the opacity of the sinus areas as compared with the detail of structure in the remainder of the skull. In this connection, care must

*Read before the Section on Otology and Laryngology of the College of Physicians at its regular meeting March 16, 1921.

be taken that a poor roentgenogram is not interpreted as a general opacity of all of the sinuses.

Absence of one or more of the sinuses will also show a lack of transparency, and this frequently involves both sides, especially in the frontal region. This must not be confused with the diagnosis of total opacity due to exudate, and can be definitely differentiated by a lateral view compared with the frontal views. In practically all instances, even in the posteroanterior view or frontal view of the frontal sinuses, the outline of the sinuses can be demonstrated, even though both sides are totally filled up with exudate.

The great advantage to the rhinologist of a complete examination of the accessory sinuses consists in the accurate information which he can obtain as to the exact size of the sinuses, the location of the septa, and the localization of the exudate. Sometimes this exudate is confined to a definite pocket. Localized pockets of pus within the ethmoids are especially difficult to determine by any other means.

Tumors of the accessory sinuses may be either primary or secondary. If secondary the disease is usually an extension of an epithelioma from surrounding structures. If primary, it is usually some form of sarcoma. In practically all instances there is, in addition to the exudate within the sinus, a destruction or expansion of the walls of the sinus. If of slow growth there may be simply expansion or even increased bone formation such as occurs in the osteomas. When these tumors are malignant there is practically always an actual destruction of the surrounding walls. Most frequently these tumors involve the maxillary sinuses and a pressure inward of the inner wall, a destruction of the outer wall, and very commonly a destruction of the alveolar process may be recognized. Frequently there is invasion backwards into the ethmoid cells.

Disease of the bony walls of the accessory sinuses will present the characteristics peculiar to the nature of the disease, but most frequently it consists of an osteomyelitis either pyogenic or syphilitic. In both these instances there is associated exudate within the sinuses and destruction or sclerosis depending upon the acuteness of the infection and the differentiation of these two conditions must be made by other clinical means.

TECHNIC.

It is my recommendation and custom to make a complete examination of all the accessory sinuses rather than to attempt to confine the study to one particular group. A more extended study, however, can be made when special information is required concerning one particular group. As a routine I make three posteroanterior views. I prefer to have the patients lying down because they are more liable to keep perfectly still, and absolute stillness is essential. Complete fixation of the head is also essential, for any slight movement disturbs detail. I make three posteroanterior views. First, for the best demonstration of the frontal sinuses, I pass the central ray at an angle of 35 degrees from the plane passing through the glabella and external auditory meatus and directed towards the frontal sinuses. This view demonstrates the lateral and vertical limits of the frontal sinuses best, but also gives some information with regard to the outline of the sphenoids and the upper ethmoid cells. The second view is taken with the central ray passing in a line connecting the external auditory meatus and the external canthus and of course centered over the median line. This demonstrates to the best advantage the vertical and lateral outline of the sphenoids. The third posteroanterior view is taken with the central ray passing immediately below the level of the mastoid processes in the median line and directed toward the maxillary sinuses. This projects the base of the skull above the maxillary sinuses and gives a clearer view, obstructed only by the overlying shadows of the vertebra and the tissues of the neck. It is very important in making the posteroanterior views that the head be perfectly level. That is, the vertical plane passing through the external auditory meati must be parallel to the film. This can be accomplished by means of the head leveler previously described by me.¹

I then make a lateral view of one or both sides, and these lateral views can be made stereoscopically. Sometimes a stereoscopic view is of advantage, but in general I have gained little from the stereoscopic study of these sinuses. This lateral view will demonstrate the depth of the frontal sinuses and the thickness of their walls together with any modification

in their normal transparency. The condition of the bony walls can be ascertained, especially the frontal sinuses, and also of all of the other sinuses. This lateral view also shows the vertical and anteroposterior dimensions of the sphenoid sinuses, but it does not permit a differentiation of one from the other. At times, when the two are not of uniform size and one is opaque, this latter can be recognized because of the projection of a clear space surrounding it made by the clear and larger sphenoid sinus. In this lateral view one is able to study the outline of the maxillary sinus in its vertical and anteroposterior dimensions, but since one is superimposed upon the other, little differentiating value is obtained. This lateral view also gives considerable information as to disease in the ethmoids, but because they are superimposed upon one another the disease on one side or the other cannot be differentiated. In addition to these views, the sphenoids may be studied by oblique views by which the shadow of the sphenoids are projected alternately into the orbital space, first on one side and then on the other, as previously described by me.² One can also study with advantage the maxillary sinuses obliquely, this study being especially desirable when there is suspicion of infection from the teeth or when there is disease of the walls of the sinuses. This has also been previously described by me.³

NEW TECHNIC FOR THE VERTICAL EXAMINATION OF THE
SPHENOIDS AND MASTOIDS.

Much difficulty and dissatisfaction has been encountered in the demonstration of the sphenoids and ethmoids by vertical view; that is, in the demonstration of the horizontal plane of these sinuses, so as to project them side by side in horizontal section. Heretofore it has been necessary to project the outlines of these sinuses through the vertex of the skull or downward within the submaxillary space and below the tissue of the neck. In either instance the position of the sinuses is so far away from the photographic film that there is much distortion and great want of definite detail. With the object of bringing the films nearer to the sphenoid and ethmoid cells to be photographed I have devised a method of placing a special film into the mouth, pushing it backward firmly against the pharynx. This gives a definite level for the projection of

the outlines of these sinuses and eliminates most of the irregular extraneous shadows of overlying bones. One has then above this film only the base of the skull and in this small area one practically obtains only the outlines of the sphenoid sinuses and the ethmoid cells surrounded by a border of teeth in the upper jaw. A preliminary report on this method of study was made by me before the American Roentgen Ray Society in discussion.⁴

Many difficulties have been involved in this procedure. In the first place it is necessary to cut the films to the exact size and shape that will fit the average mouth and pharynx. I obtained this first by finding a size that would best fit my own mouth and which I could hold in position comfortably when pushed entirely against the posterior wall of the pharynx. This size is 2 by 3 inches. It is square at one end and curved at the end which is pushed against the pharynx. I then found great annoyance from the secondary radiation of the tissues about the mouth, which caused a great deal of fog. This was partially overcome, even as early as 1916, by the use of metal placed underneath the film, yet there was still much disturbance from the secondary radiations of the tissues of the head because it was necessary to use, as in all vertical examinations, a comparatively hard ray. More recently I have overcome this by using double screens, which I have cut to exactly fit this special film. The double screens are attached by means of a hinge, the lower one being attached to a layer of brass. Special black paper envelopes are made to fit these holders and they are rendered waterproof by covering them with rubber. This double screen technic permits the use of much softer radiation, which gives rise to less scattered rays. Fig. 1.

This examination is made with the patient in the sitting posture (Fig. 2). The chin is rested upon the headrest. The film is then pushed back into the mouth against the pharynx and held in place by the teeth. The distance from the target to the top of the head is 18 inches, using a 3 inch cylinder, and a vacuum corresponding to a 4 inch parallel spark gap, and an exposure of approximately 8 seconds, with 30 milliamperes of current.

By this technic we can now demonstrate clearly the outline and size of these sphenoid sinuses projected side by side, and

this gives the operating surgeon a definite idea as to the position of the septum, for in many instances the septum is distinctly to the right or the left of the median line. By this process one can also demonstrate a horizontal projection, or in horizontal section, the ethmoid cells. At times large ethmoid cells in the region of the sphenoids are involved by exudate which, by all other means, leads one to suspect disease of the sphenoids. With the definite demonstration of the location of exudate by this means, or even the demonstration that these various cells are normal, I am sure that a great advance can be made in the study and treatment of the diseases of the posterior accessory sinuses. On account of illness since developing this technic, I have not made this study as extensive as I propose to do, but I have already been greatly surprised at the great variations in the outlines of the sphenoid sinuses as well as the great variation in the size and outline of some of these posterior ethmoid cells. It is rare that the two sphenoid sinuses are of equal size, and it is very common to find the septum on one or the other side of the median line. This technic, combined with the posteroanterior and the lateral views, permits one to make a very exact and definite demonstration of the sphenoid sinuses in every plane and in every direction, and surely such exact information must be of distinct value to the clinician.

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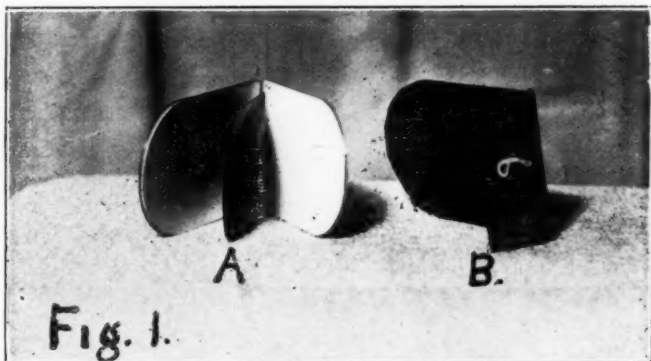


Fig. 1. (a) Shows double screen with film standing between.
(b) Black envelope for holding the screen. This must then be covered with rubber or other material to keep the film dry.

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Fig. 2. Film and double screen in position in the patient's mouth, showing the position for making the Roentgenogram.

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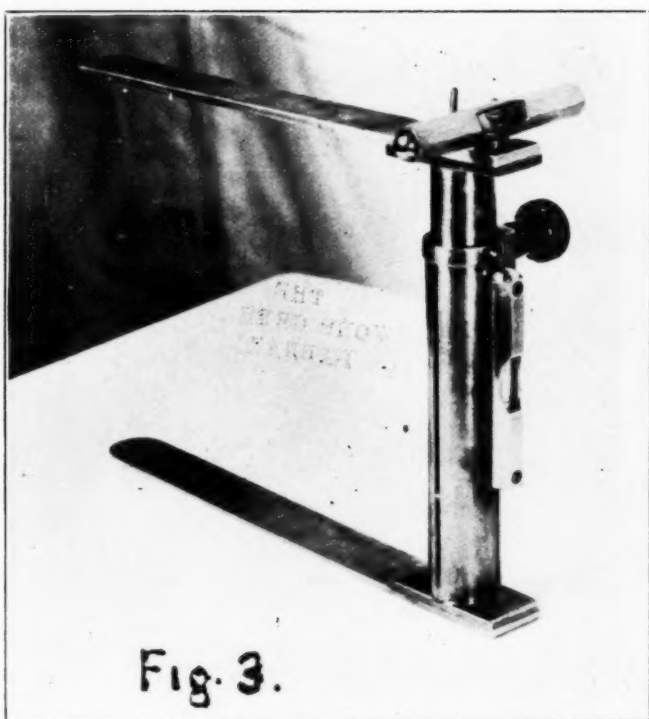


Fig. 3. Leveler for getting the position of the head in sinus work, the ends of these arms to be inserted against the small concha of the ears.

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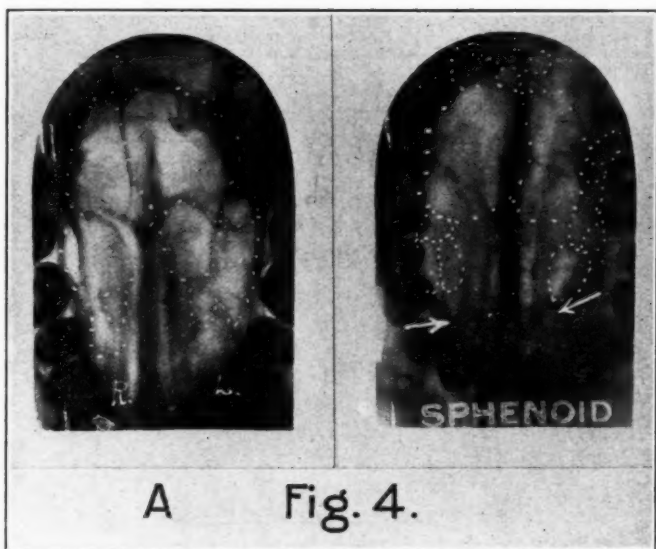


Fig. 4. (a) Normal sphenoid and ethmoid cells.
(b) Normal sphenoid and posterior ethmoid cells, with exudate
in the anterior ethmoid cells.

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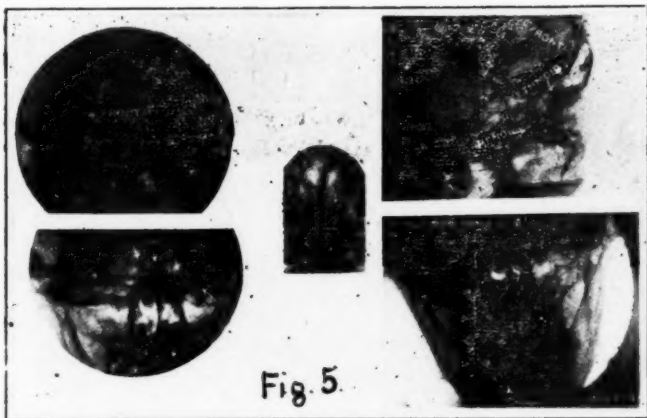


Fig. 5. Showing a complete set of sinus films and demonstrating exudate in the anterior ethmoid cells.

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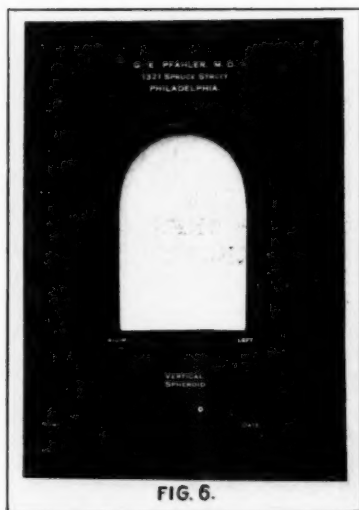


FIG. 6.

Fig. 6. Cardboard mount specially designed to hold the vertical sphenoid film.

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XVIII.

SOME EXPERIMENTS TO SHOW THE FLOW OF FLUID FROM THE REGION OF THE TEGMEN TYMPANI, EXTRADURAL TO AND MEDIAL TO THE PASSAGE OF THE SIXTH CRANIAL NERVE THROUGH THE DURA MATER TO THE LATERAL WALL OF THE CAVERNOUS SINUS.

BY H. J. PRENTISS, M. D.,

IOWA CITY, IOWA.

The reason for this study followed an inquiry from Doctor Cobb of Marshalltown, Iowa. He stated that he had an involvement of the external rectus following a mastoid operation and went into some detail regarding the case. The actual work of this experiment was carried on by Doctor I. N. Crow, who has had large experience in this department, both as an instructor and as a graduate student.

I present photographs of a head showing the flow of a colored fluid from the region of the tegmen tympani to the dorsum epiphii. Photograph I is a picture of the floor of the brain box with the dura intact. Owing to the light reflections, the shadow of the india ink in the middle cerebral fossa is not as plainly shown as over the dorsum epiphii, remembering that the glistening dura was between the fluid and the camera. Nevertheless the shadow is quite plainly seen in the right cerebral fossa and very plainly in the region of the dorsum epiphii. Photograph II is a picture of the same head showing the lines of incision through the dura. Photograph III is a photograph of the same head with the dura lifted away, exposing the india ink directly. The injections were made before the calvarium had been removed. Therefore the brain was in contact with the dura as in life. A complete evisceration of the mastoid cells was made exposing the tegmen; a small opening was then made in this roof, but not injuring the dura. A

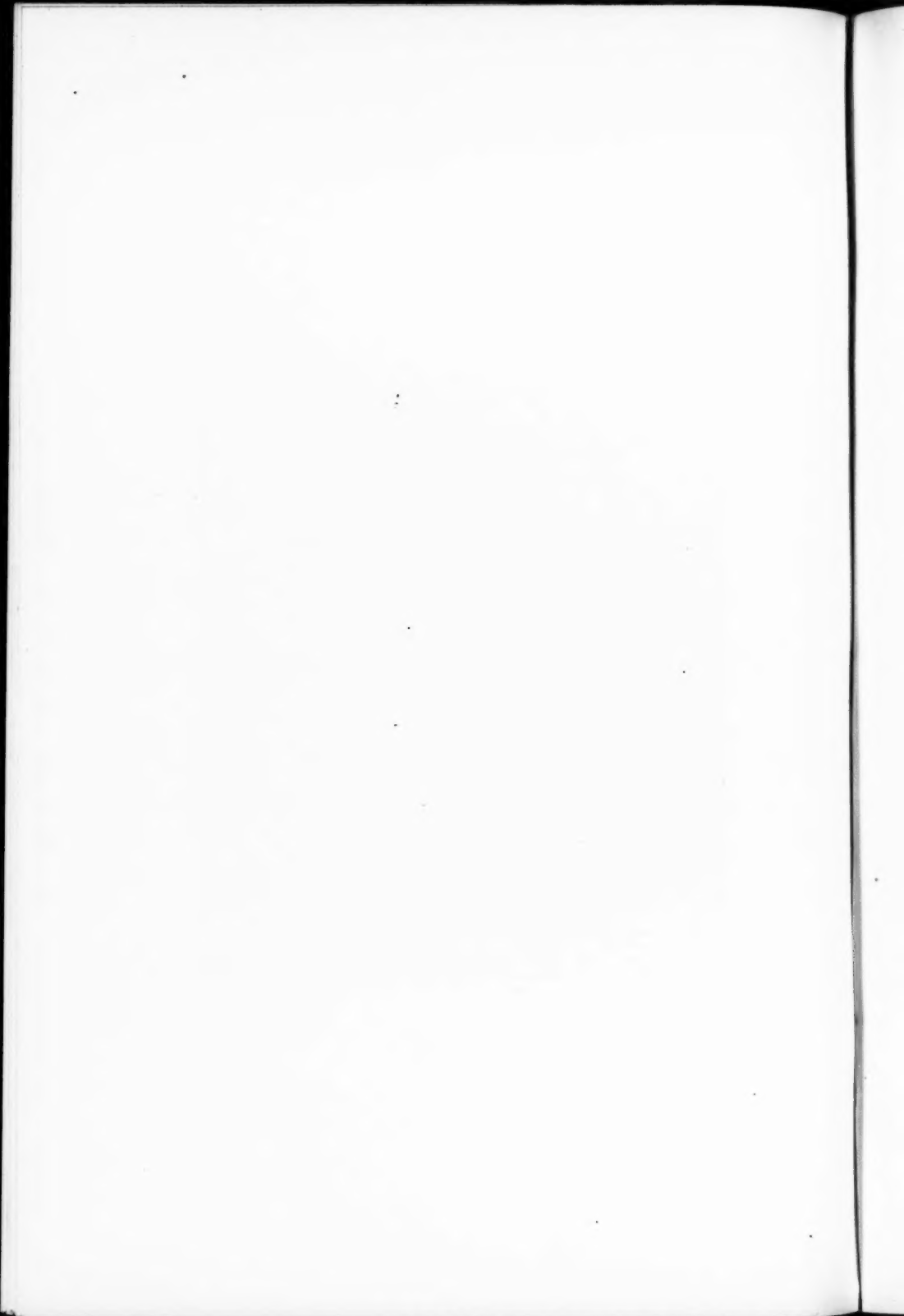
graduated syringe was inserted in this opening, and seven cc. of india ink injected. The calvarium and brain were then removed with the results as shown by the photographs. We notice in a general way that the fluid circulated medially, reached the cavernous sinus and flooded the dorsum epiphii. Lateral to the foramen spinosum and the course of the middle meningeal artery, the fluid lifted up the dura periosteal membrane broadly. It was limited posteriorly by the course of the large superficial petrosal nerve, from the hiatus Fallopii and along the groove leading to the middle lacerated foramen. The fluid passed medially over and under the Gasserian ganglion, but outside the periganglionic connective tissue sheath. The fluid continued its course medially until it reached the cavernous sinus and was then directed backward through the isthmus between the apex of the petrosa and the posterior clinoid process, thus reaching the dorsum epiphii, where it diffused between the dura and the periosteum. Here it was continuous with the injection from the other side. At the isthmus the sixth nerve grooves the lateral edge of the dorsum epiphii, and is it not conceivable that direct pressure on this nerve in this notch may cause impairment of its function?

We experimented upon twelve specimens and succeeded in four in getting the above results.

February 28, 1921.



Fig. 1.



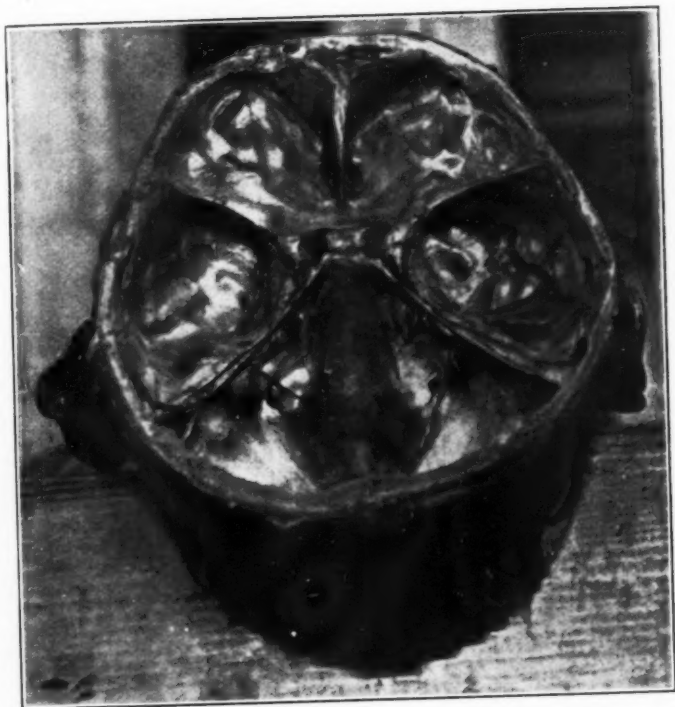


Fig. 2.

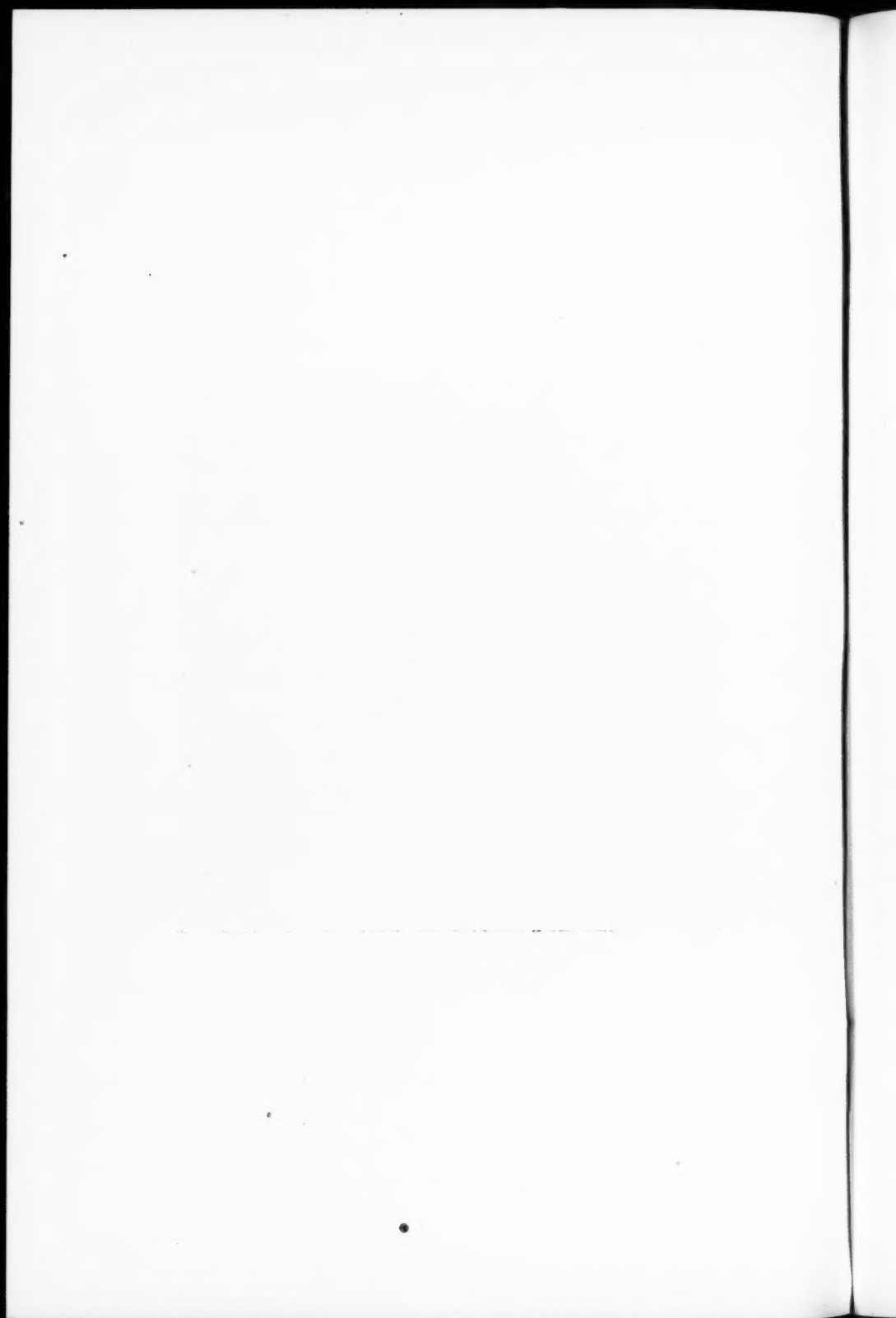
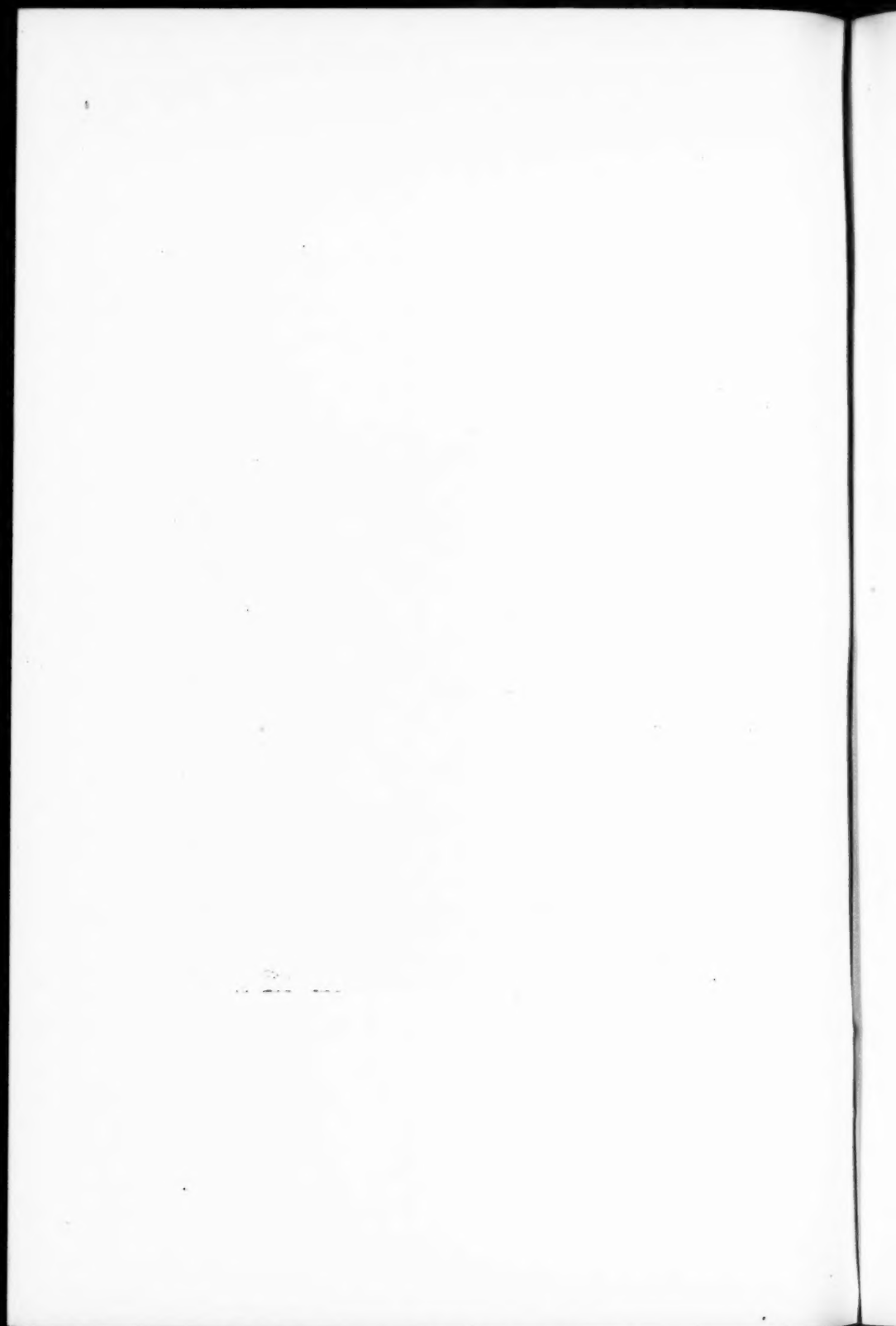




Fig. 3.



XIX.

FOSSA OF ROSENMUELLER.

By H. J. PRENTISS, M. D.,

IOWA CITY, IOWA.

The head specialists are so boldly exploring the remote regions of their specialty that it occurs to the writer some observations on the anatomy of the fossa of Rosenmueller may be helpful. The texts are curiously obscure, and though some have excellent illustrations of this region, yet the descriptive discussion is far from satisfactory.

The fossa of Rosenmueller is a lateral extension of the nasopharynx, dorsal to the Eustachian tube and the levator palati. It would seem to be a part of the first visceral pouch, the other part being the Eustachian tube, carried into the expanded middle ear. The nasopharynx is described as hour-glass in shape, being expanded above at the base of the skull, contracted at the attachment to the dorsal edge of the internal pterygoid plate, and then expanding into the oral pharynx by its attachment to the inner surface of the mandible at the posterior limit of the mylohyoid ridge. Fig. 1 shows a posterior view of one-half of the pharynx suspended from the skull. The skull is markedly flexed or depressed. The left side illustrates the bony structure, the dotted line presenting the pharyngeal attachments. We know that the musculature of the pharynx is applied over a very powerful submucosa called the pharyngeal aponeurosis. Of course, where the pharynx ceases ventrally, this aponeurosis ends, the mucosa only being continued into the nasal, oral and laryngeal cavities.

What are the attachments of this aponeurosis? Beginning in the median line, on the basilar process of the occipital bone, is the middle pharyngeal spine to which is attached the pharyngeal raphe. From this point the pharyngeal aponeurosis swings laterally and somewhat posteriorly over the rough quadrilateral surface on the under surface of the petrous portion of the temporal bone, to attach to the lateral pharyngeal spine. This name is given to the inner and anterior limit of the tympanic plate or annulus of the temporal bone, which is

quite massive at this place and overhangs the pharyngeal crest which runs from this point to the apex of the petrous bone. Figs. I, II, III. The pharyngeal crest divides the under surface of the petrosa into two unequal parts. The anterior and smaller surface or tubal surface helps support the Eustachian tube. The posterior surface presents the eleven points of interest so well known or unknown. This pharyngeal crest runs from the lateral pharyngeal spine to the apex of the bone and continues into the inner plate of the pterygoid process, medial to the scaphoid fossa. Fig. II. Along this crest the delicate mucosa of the pharynx attaches, separating the fossa of Rosenmueller from the tube and beneath from the levator palati. These two structures are entering the pharynx above the sinus of Morgagni, and where, therefore, the pharyngeal aponeurosis ceases as such. Figs. II, IV, V.

Leaving this crest the mucosa passes directly to the inner pterygoid plate, down this plate to its hamular process, and from there swings laterally to the inner surface of the mandible, along the pterygomandibular raphe. At the mandible it attaches by a small attachment at the posterior limit of the mylohyoid ridge. Fig. 1. The superior constrictor muscle does not follow the pharyngeal mucosa to the lateral pharyngeal spine, but swings forward beneath the fossa of Rosenmueller to attach to the lower half of the internal pterygoid plate, as a rule. Fig. I.

Viewing the pharynx from behind, one observes how the nasopharynx swings around the internal pterygoid muscle in reaching its attachments. Fig. I.

Due to this definite lateral attachment of the fossa of Rosenmueller, the foramen ovale for the passage of the inferior division of the fifth cranial nerve is anterior, being separated only by the eustachian tube. The carotid foramen for the internal carotid artery is directly behind this lateral attachment with nothing intervening. Fig. I, II.

Summary.—The fossa of Rosenmueller is a contracted cone (contracted ventrodorsally). Its apex reaches to the lateral pharyngeal spine. Its base opens into the general cavity of the nasopharynx. Its anterior wall is a delicate mucosa covering the eustachian tube and levator palati. Its posterior wall is the mucosa covering the dense pharyngeal aponeurosis. At its apex, in front is the inferior maxillary division of the fifth cranial nerve, and behind the internal carotid artery.

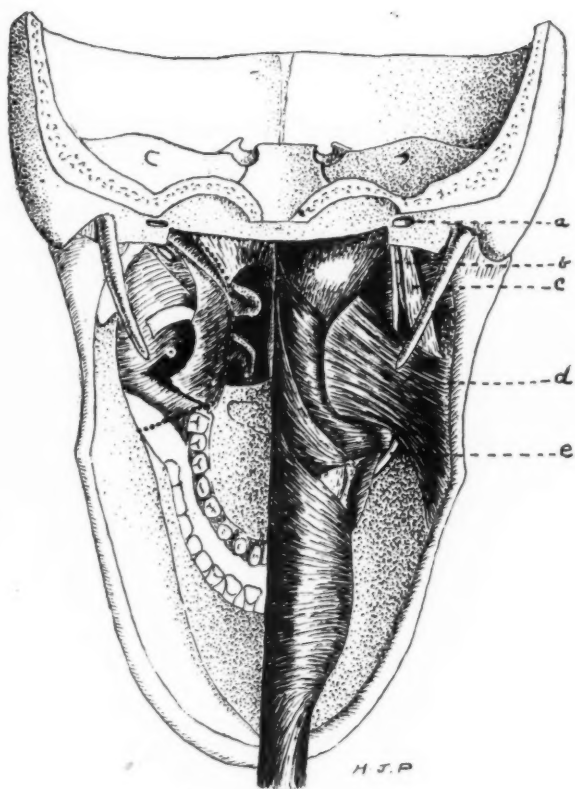
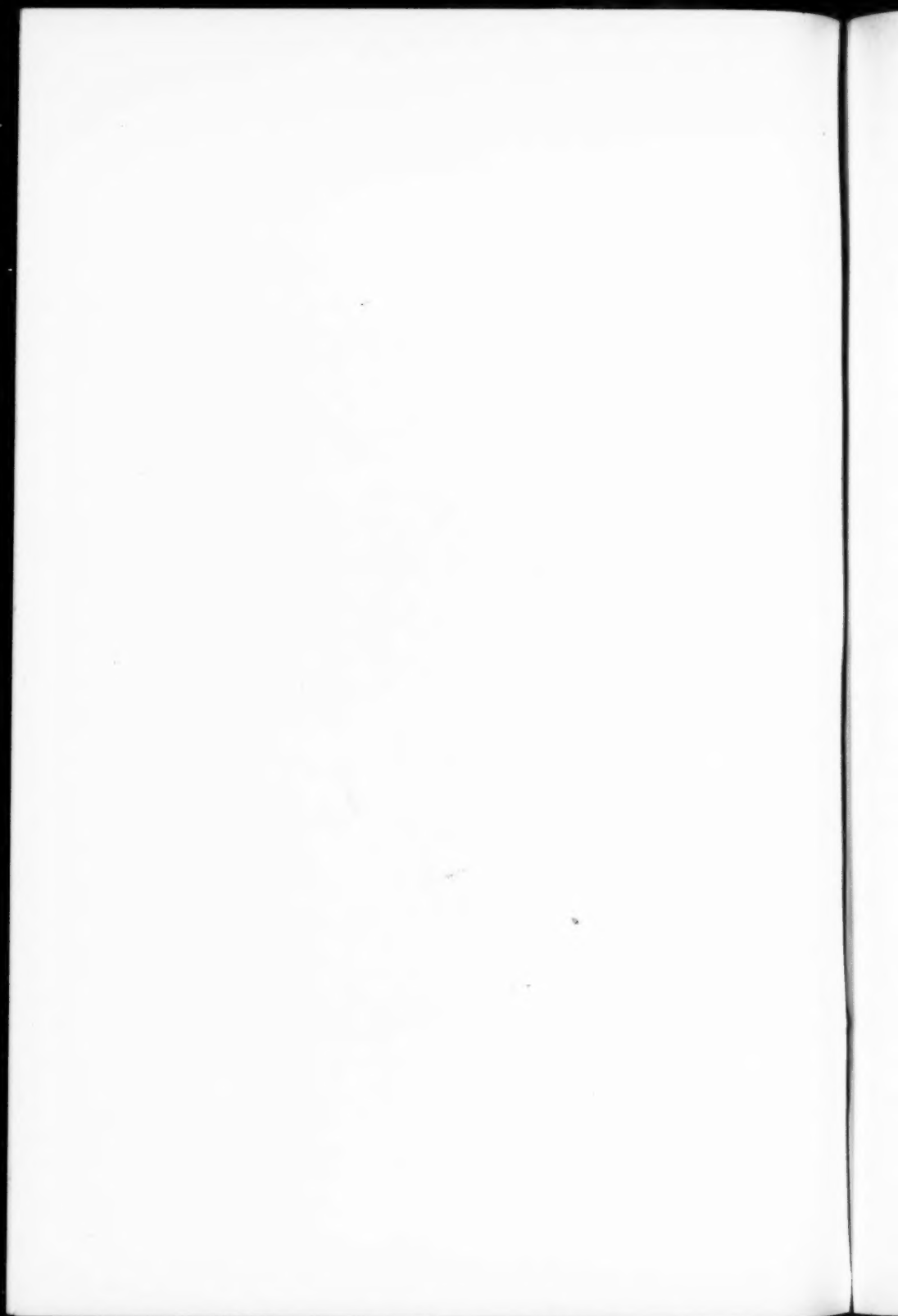


Fig. 1.

Posterior view of one-half of pharynx. a—Carotid foramen. b—Third division of fifth cranial nerve. c—Spheno-mandibular ligament. d—Internal pterygoid muscle. e—Lingual nerve wrapping around attachment of pharynx mandible.



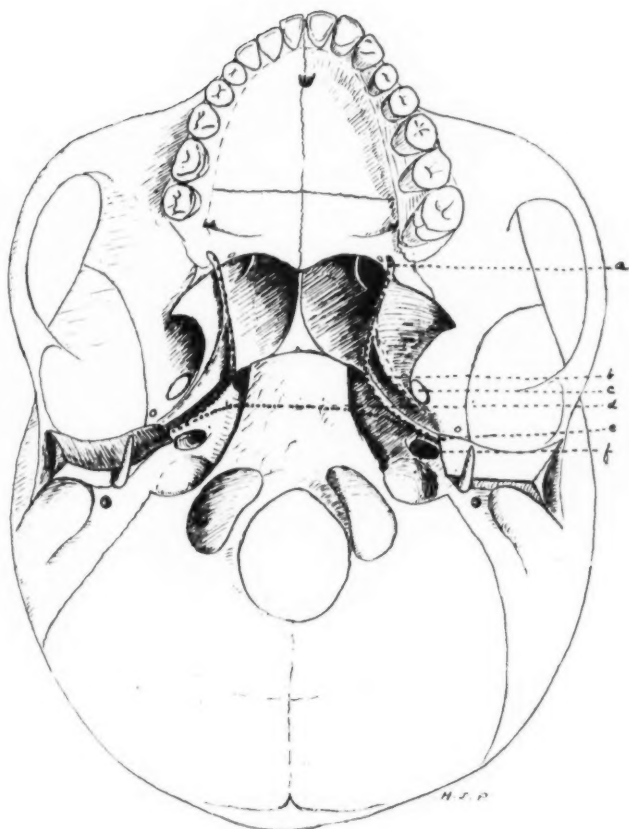
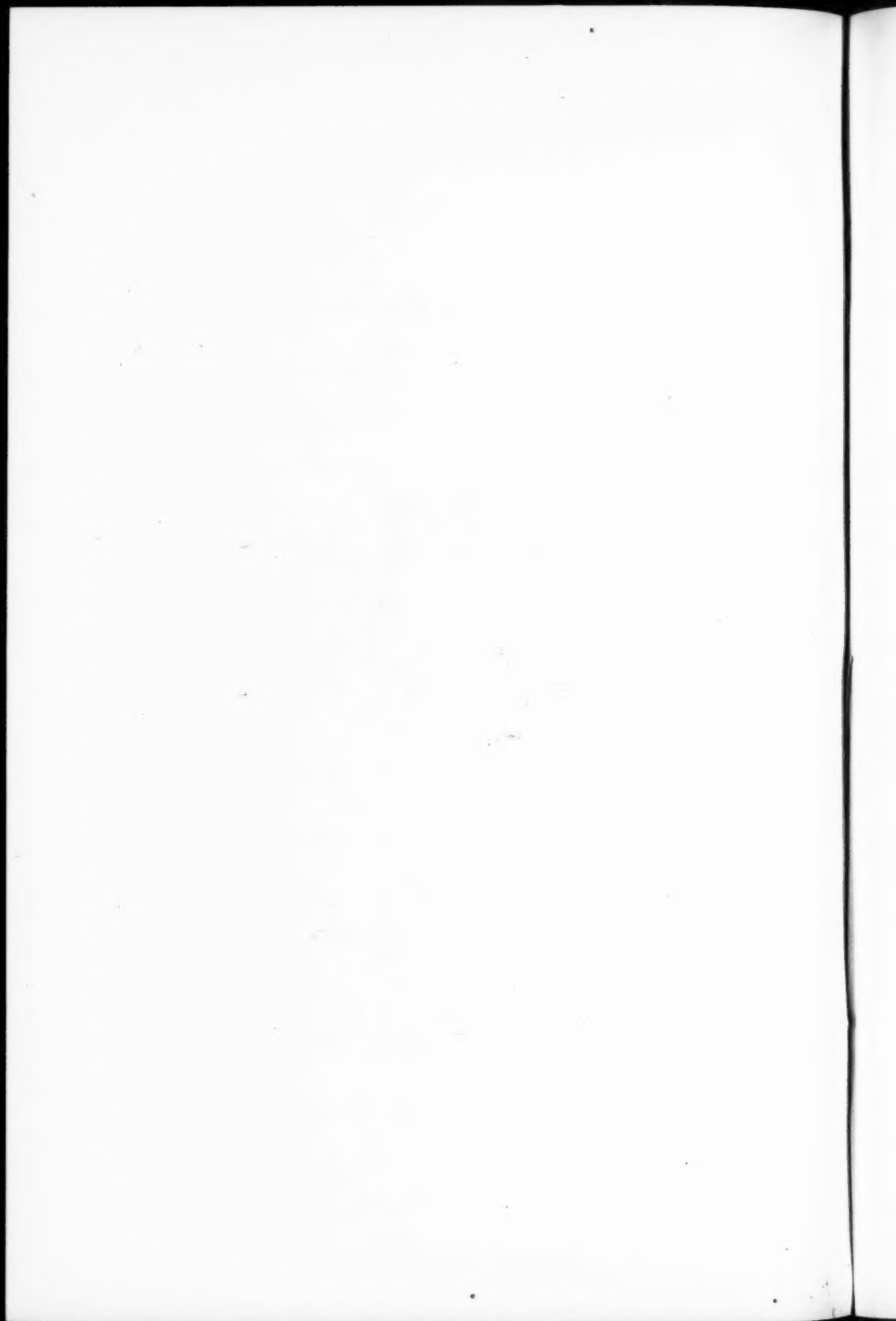


Fig. 2.

To show naso-pharyngeal attachments. a—Hamular process.
 b—Scaphoid fossa. c—For. ovall. d—Medial pharyngeal spine.
 e—Lateral pharyn. spine. f—Carotid foramen.



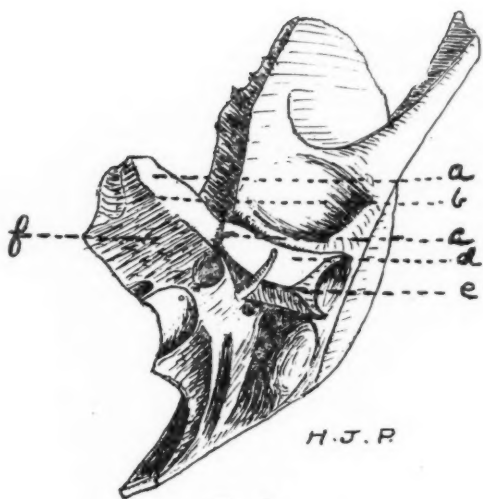
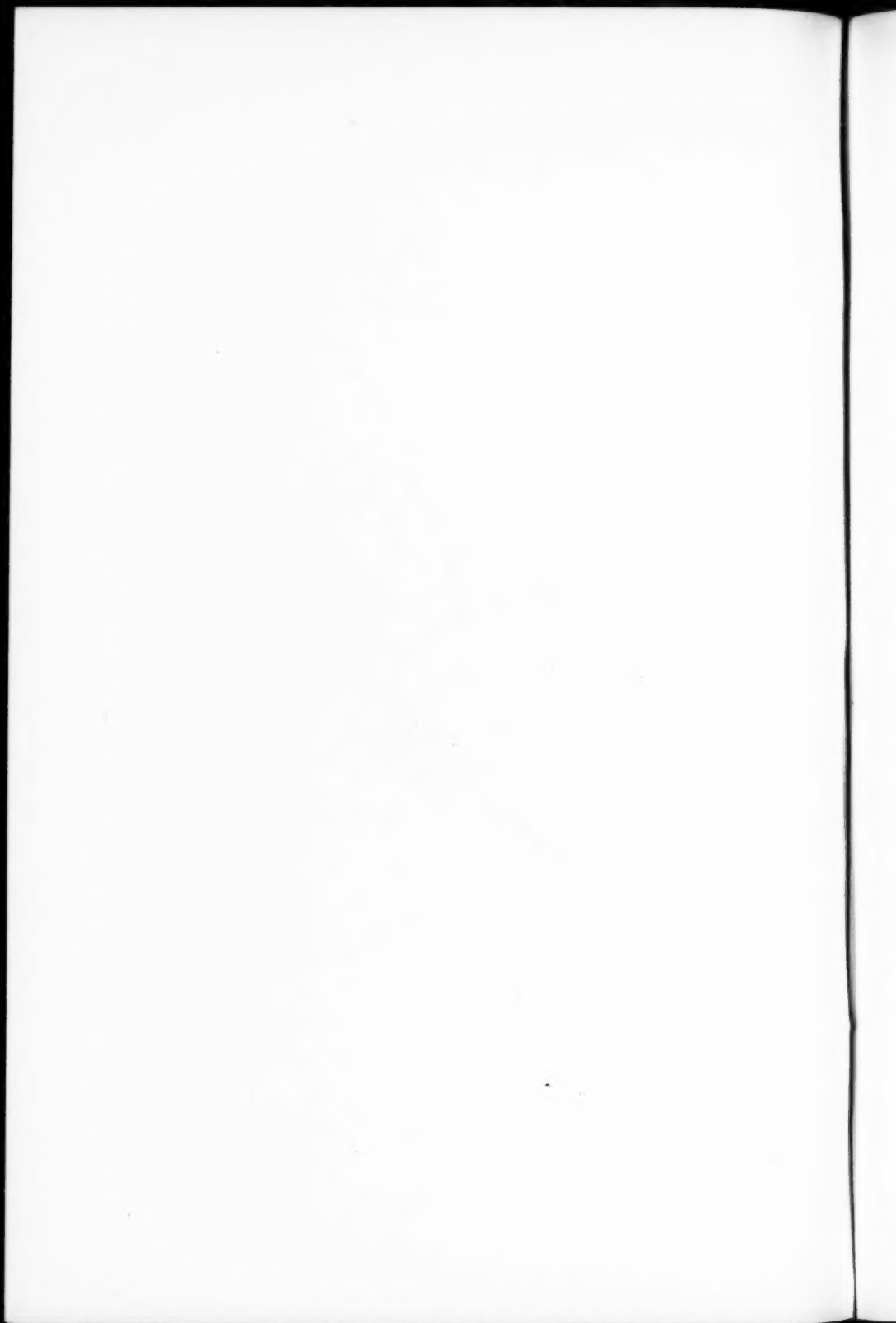


Fig. 3.

Under surface of temporal bone to show lateral pharyngeal spine and pharyngeal crest. a—Tubal surface. b—Pharyngeal crest. c—Lateral pharyngeal spine. d—Annulus or tympanic plate. e—Vaginal process. f—Rough quadrilateral posterior surface.



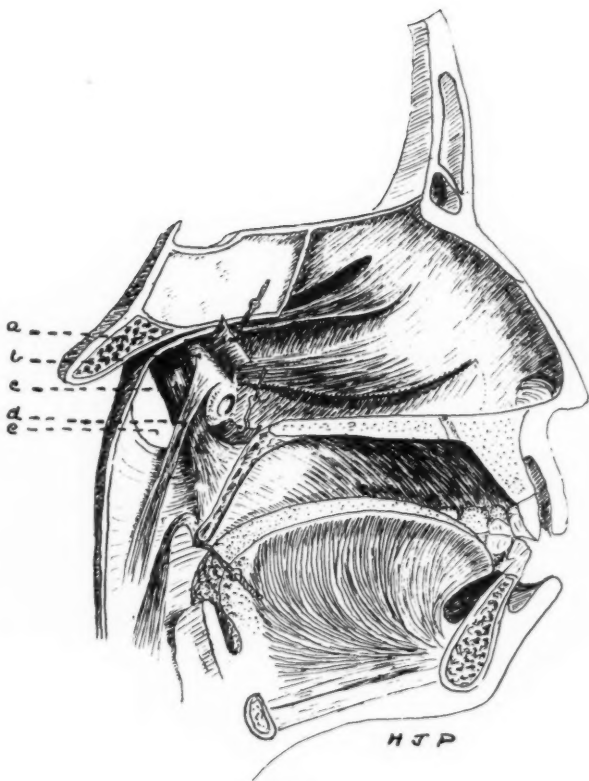
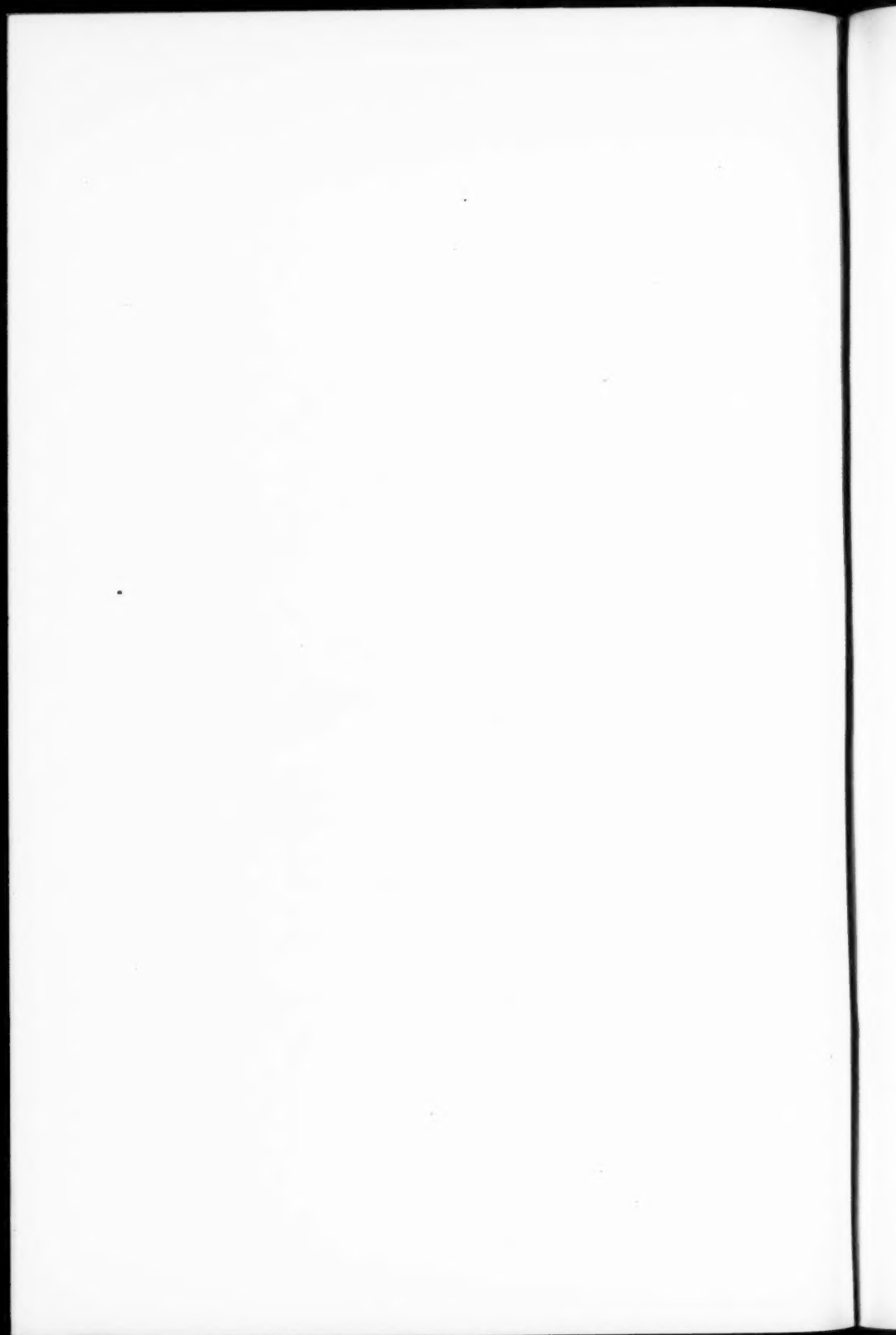


Fig. 4.

Fig. 4. To show the eustachian tube and lev. palati in anterior wall of fossa of Rosenmueller. Mucosa removed. a—Reflected mucosa. b—Eust. tube. c—Lev. palati. d—Salpingo-pharyngeus muscle. e—Sinus of morgani.



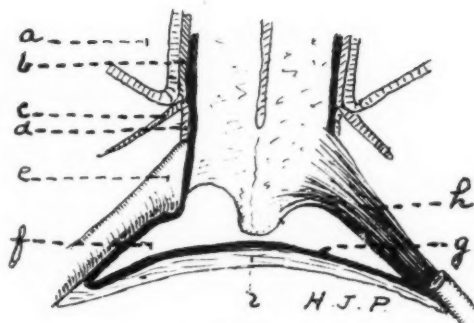
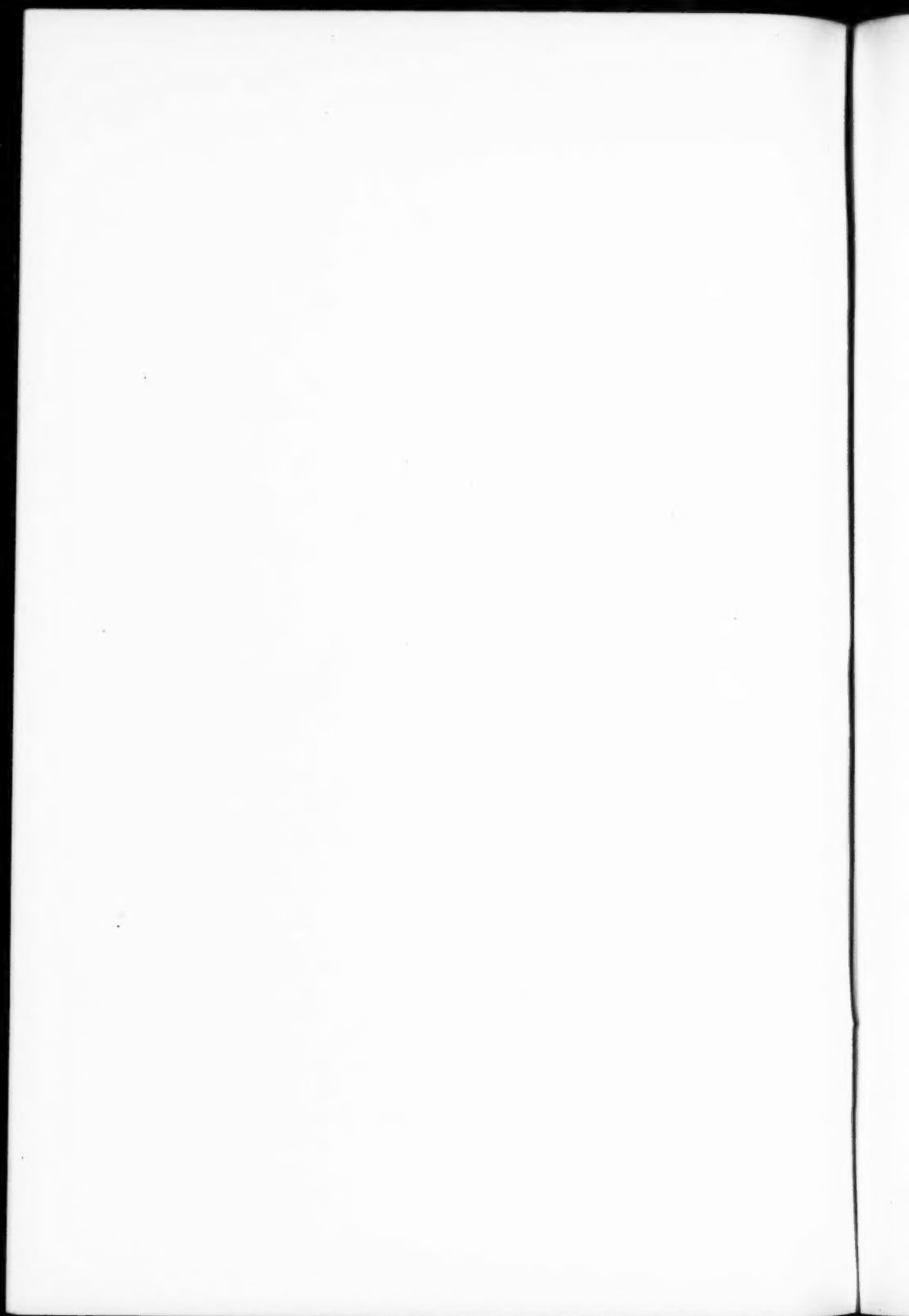


Fig. 5.

Fig. 5. View from above, diagrammatically showing fossa of Rosenmueller. Right side—Eustachian tube removed to show lev. palati beneath. a—Antrum. b—Vert. plate of palate bone. c—Ex. pterygoid plate. d—Internal pterygoid plate. e—Eustachian tube. f—Fossa of Rosenmueller. g—Mucosa. h—Lev. palati. i—Pharyngeal aponeurisis.



XX.

SOME OBSERVATIONS ON THE MASTOID PROCESS AND ITS CELLS.

By H. J. PRENTISS, M. D.,

IOWA CITY, IOWA.

The various texts call attention to the presence of small cells in the apex of the mastoid process of the temporal bone and small cells at the base. The department of anatomy in the University of Iowa finds a goodly number show large cells toward the apex and small cells in the region of the triangle of election or Macewen's triangle. (Fig. 1).

A study of this quite common variation from the text has led to a study of the reason for this variation in the two types of cells. As the result of these findings we believe that the point should be emphasized that the mastoid process is a petro-squamo-mastoid process and not a petro-mastoid process.

Referring to Figures 2, 3, 4, 5 and 6A and B, we observe sketches of temporal bones or parts of these bones at term. Fig. 2 is a lateral view of the entire bone. Note that the squamosa extends well down, posterior to the external auditory canal. Fig. 3 shows the squamosa removed, leaving the petrosa. Note that the dependent portion of the squamosa closes in the lateral side of the mastoid antrum, forming therefore its lateral wall in the complete bone. The roof, floor and medial wall is formed by the petrosa. Fig. 6A.

Fig. 4 shows the lateral view of the squamosa and annulus. Fig. 5 shows a medial view of the same two bones. Note how this view indicates that the squamosa has two tables which separate in the region of the antrum and attic, leaving the single outer table as the lateral wall of the antrum and attic. This inner table at the place of separation articulates with the tegmen tympani and the outer table, at a lower level, with the petrosa, in the region of the antrum and with the drum membrane in the region of the epitympanic recess. (Figs. 6A and B). Fig. 6A is a schematic vertical section through the antrum at term, and Fig. 6B, through the drum membrane.

With the great lateral growth of the brain, after birth, the squamosa develops a horizontal portion, there being only a vertical portion at term. This horizontal portion develops into the eminentia articularis, glenoid fossa, roof of the external auricular canal, besides the mass of cells leading from the lateral wall of the antrum. (Figures 7D and C). Fig. 8 is one of a series. A vertical section was made through the external auricular canal, not injuring, therefore, the posterior wall of this canal and also exposing the antrum. The lateral wall of the antrum was painted with a wax, making it impervious to fluids. Pouring a colored fluid into the antrum, the apical cells were invaded, but not the lateral cells. Removing this wax, thus opening into these lateral cells, and then painting the remaining walls with a melted wax, on pouring into the antrum a differently colored fluid, the lateral cells were invaded, but not the apical cells. After these injections were made, the cortex was ground away with the resulting picture of the two sets of cells. Fig. 8.

In a certain number of specimens this sharp differentiation was not obtained, the two fluids mingling. That a few specimens showed this sharp differentiation indicates that there is a tendency for a persistence of this separation in the adult bone. The clinical men note that apical cells may be involved, and not basal cells, and vice versa.

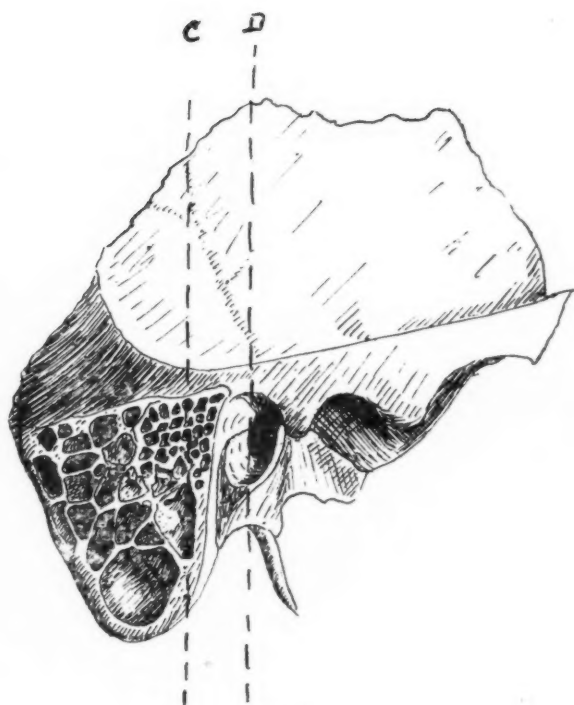
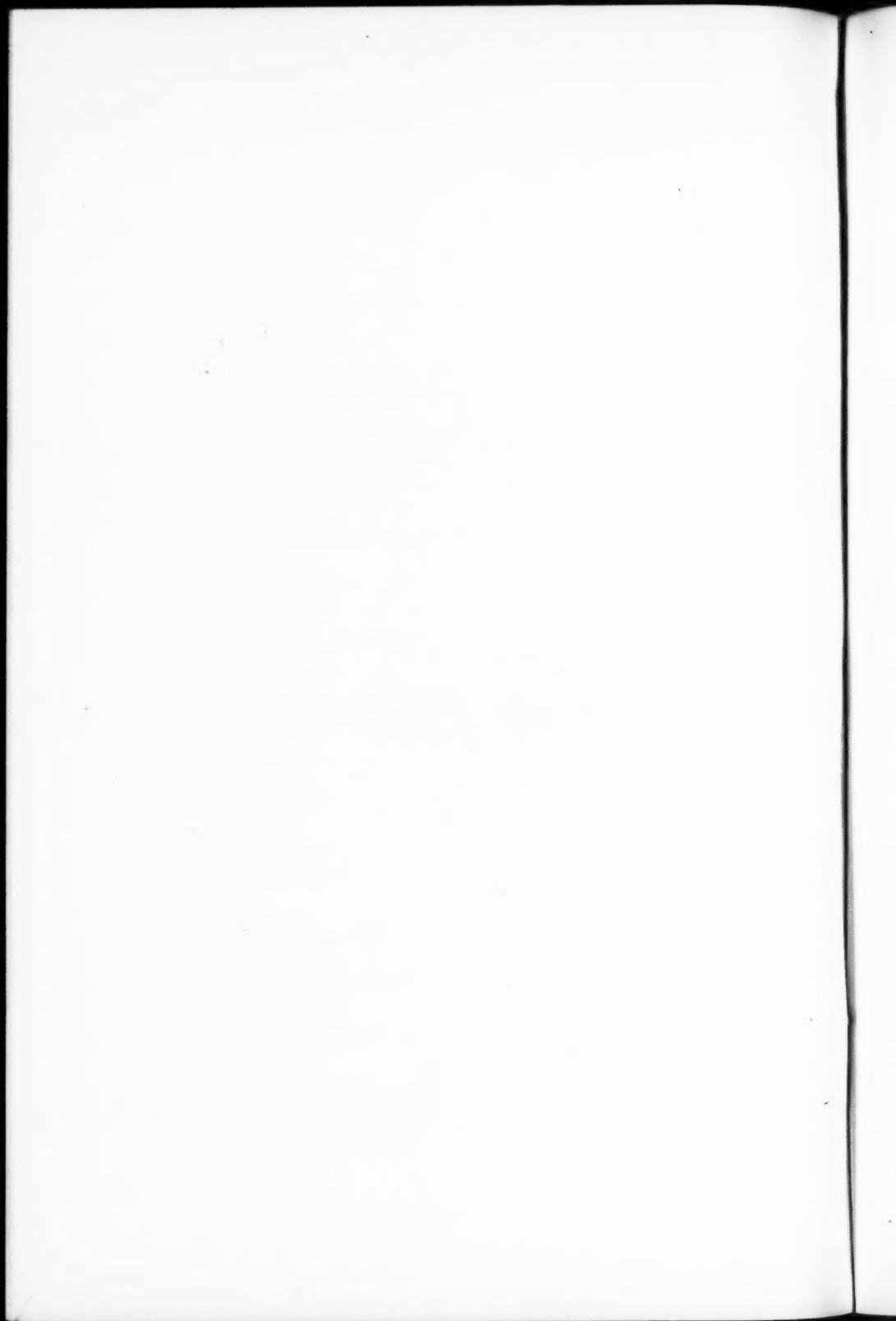


Fig. 1.



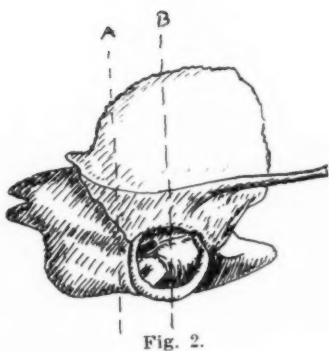


Fig. 2.



Fig. 3.

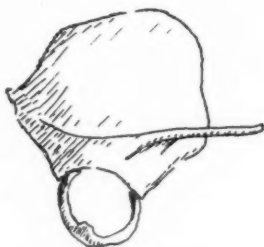


Fig. 4.

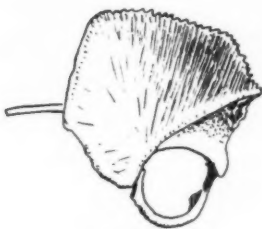


Fig. 5.

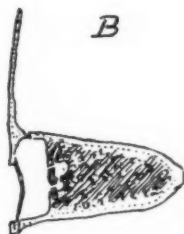
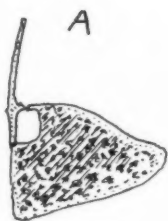
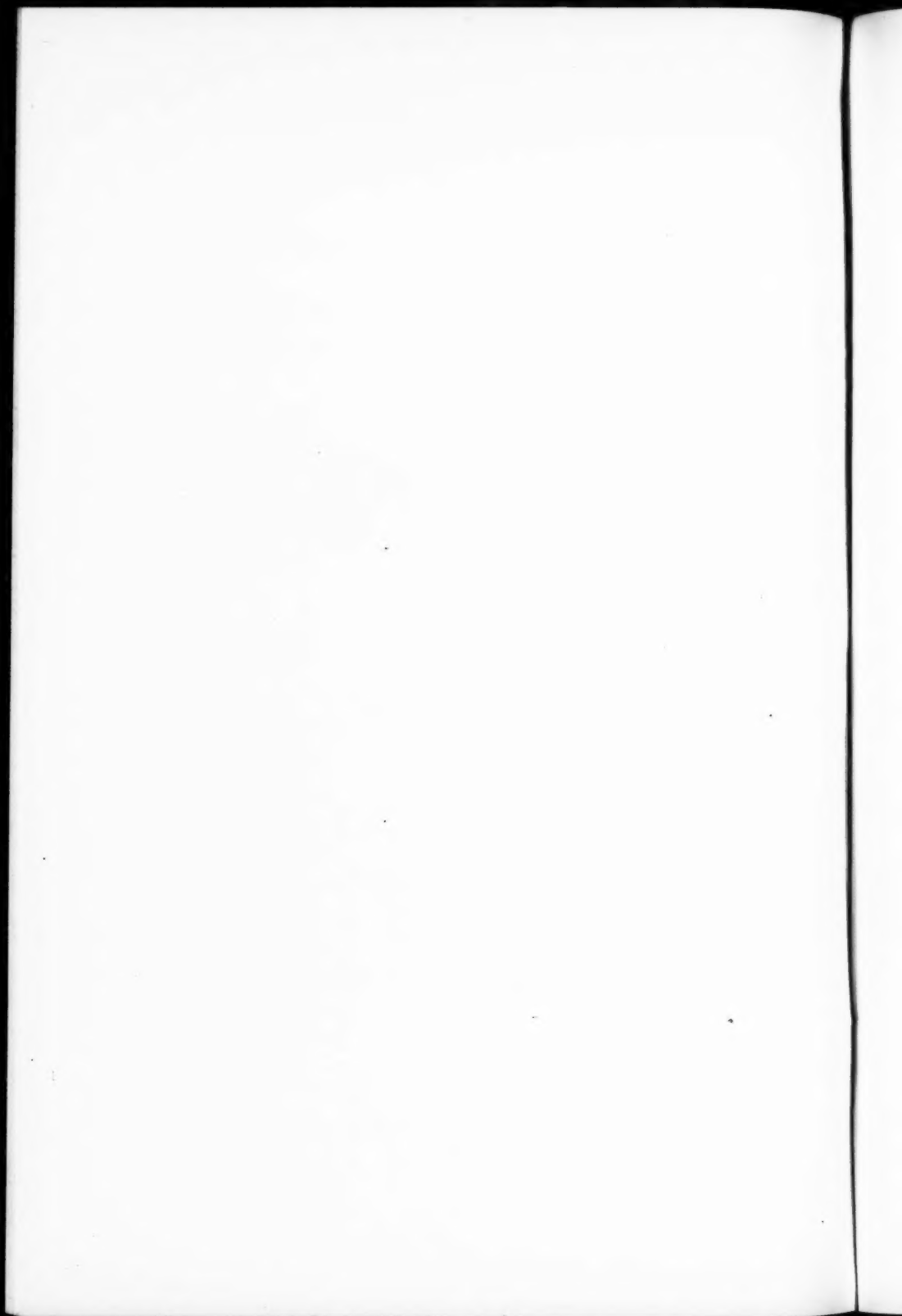


Fig. 6.



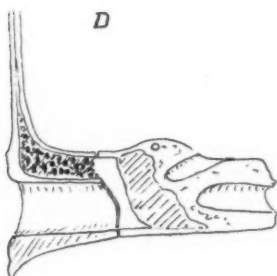
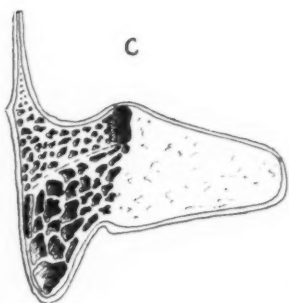


Fig. 7.

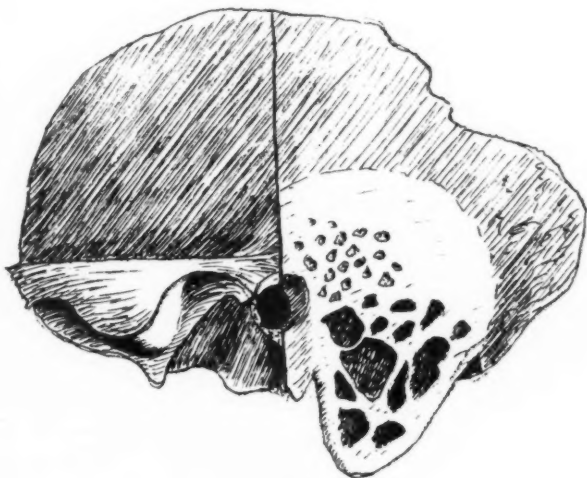


Fig. 8.

3

XXI.

FURTHER REPORT ON THE USE OF RADIUM, THE X-RAY AND OTHER NONSURGICAL MEAS- URES, COMBINED WITH OPERATIONS ABOUT THE HEAD AND NECK.*

By JOSEPH C. BECK, M. D.,

CHICAGO.

In presenting for your consideration the material with which I have busied myself for the past twenty years or more, in other words, since X-rays, radium and other similar modes of treatment have been in vogue, I am hoping to elicit a discussion so that I may learn more.

While I am sure that I shall not be able to bring out anything new or original, I do know that I am presenting a fair amount of material, most of which is malignant disease, and unfortunately accompanied by an enormous mortality. I am further cognizant of the fact that my report is accurate although pessimistic as to the ultimate results. If reporters on malignant disease will carry out this plan they will go a long way towards progress and assist that grand society, organized principally for control of cancer.

It is only by following up our cases and repeatedly making reports upon them that any sort of statistics can be prepared.

In order to save the reader looking up my previous papers, I wish to state that in 1904 I reported on the "Use of X-ray and Radium in Cancer About the Nose, Throat and Ear" (1) with negative results. In 1907 I reported on "X-ray, Radium and Fulguration in Malignant Disease of the Nose, Throat and Ear" (2). In this report I found no result—that is, cures from these remedial agents. In 1912 I reported on the "Use of Autolytic Solution in Combination of Operations and X-ray in Cancer of the Head and Neck" (3), with encourag-

*Read before the College of Physicians and Surgeons, Philadelphia. Also Middle Section of the American Laryngological, Rhinological and Otological Association, Cincinnati, February, 1920.

ing results in a limited number of cases. Subsequent application of this treatment (autolytic solutions of cancer) in a large group of carcinoma cases proved it to be of no specific value.

In 1914, I reported on "Carcinoma of the Larynx With Special Reference to Radium Therapy" (4), in which one case was described in detail. Extensive study was reported upon the microscopic changes of the carcinoma by the use of radium; no startling results were reported in this paper, nor any cure of extensive carcinoma.

In the same year (1914) I reviewed the entire literature for the last twenty years, of "Nonoperable Methods of Treatment of Inoperable Malignant Disease" (5), and showed in the conclusions that authentically no cures had been reported from any of these procedures, but that X-rays, radium and allied agents and chemical substances, like the colloidal, copper, silver, etc., also eosin compounds, promised results.

In 1917, I presented "Experience With Suspension Laryngoscopy in Over Two Hundred Cases, With Report" (6), in which I cited a most encouraging case of carcinoma of the larynx that apparently was cured by surgical procedure, carried out through the intralaryngeal route, by suspension laryngoscopy, and the employment of deep X-ray therapy, both before and after operation. As will be shown later, I was too hopeful in this case.

In the same year I presented two papers entitled "Further Report on the Treatment of Malignant Disease of the Larynx" (7) and "Management and Statistics of Malignant Disease of the Upper Respiratory Tract" (8). These papers were profusely illustrated, especially with case reports, many of which are again presented in this paper, because at that time many had just been operated upon, whereas I report on their subsequent course now.

The region to which I confine my treatment is the head and neck, which comprises ophthalmologic, otolaryngologic, stomatologic, oral and general surgery, as well as the dermatologic field. The pathologic conditions that I have treated are:

1. Carcinoma, epithelioma and adenocarcinoma.
2. Sarcoma.
3. Endothelioma.

4. Papilloma.
5. Angioma.
6. Lymphangioma.
7. Fibromyxoma.
8. Neuroma.
9. Chloroma.
10. Fibroma.
11. Adenoma.
12. Lymphoma.
13. Lypoma.
14. Cystoma.
15. Epulis.
16. Osteoma.
17. Verruca.
18. Rhinophima.
19. Leucoplakia.
20. Paraphinoma.
21. Syphiloma.
22. Keloid.
23. Tuberculoma.
24. Exostosis and osteitis.
25. Hematoma.
26. Abscess.

The forms of treatment employed were:

1. Surgical.
2. X-ray (surface and deep).
3. Radium (surface and deep).
4. Surgical diathermia.
5. Cautionary (sprays and galvano- and electrolysis and ionization).
6. Lysins and chemotherapy.

To bring out details in the management of these various pathologic conditions, I have decided to pass in review some of the cases which I have treated and observed, selecting one case of each type, stating the history in the briefest possible manner, omitting the reports of negative findings or laboratory tests, as for instance, Wassermann, etc. (some of the conditions cannot be presented in illustrations because nothing showed externally). In the conclusion of your discussion, I

will be pleased to answer any question which may have been omitted in the presentation.

Case 1 (Fig. 1).—Male, age 53 years. Clinical diagnosis: Epithelioma of right lower lid. Applied 50 mg. of radium

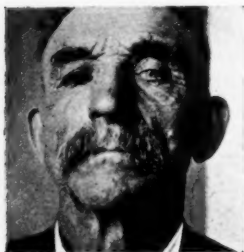


Fig. 1.

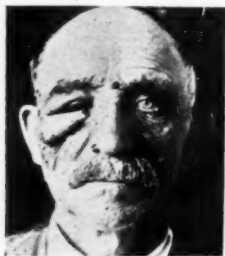


Fig. 2.

element screened by 1/10 mm. of aluminum, this for eight hours.

The following morning I excised the growth wide of the involvement and immediately performed a plastic (pedicle method) operation for reconstruction of the lid. (Fig. 2.) Two weeks later I rearranged the flap to make a better cos-

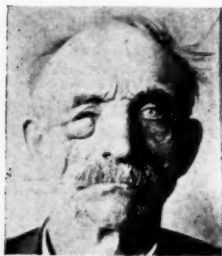


Fig. 3.



Fig. 4.

metic effect. (Fig. 3.) The microscopic examination of the mass removed showed a distinct epithelioma and areas can be made out of changes due to the radium application.

Case 2 (Fig. 4).—Male, age 48 years. Clinical diagnosis: Epithelioma of the inner canthus and lower lid, side of nose and face on left side. This I removed surgically wide of its

point of involvement. After the wound was healed and observed for a short time a recurrence was found about the nasal margins. Fifty mg. of radium pure was applied, screened by 1.4 mm. of aluminum for six hours, once a week



Fig. 5.



Fig. 6.

for five weeks. (Fig. 5.) Three months later, no recurrence.

Case 3 (Fig. 6).—Man, aged 67. Diagnosis, clinically and microscopically: Epithelioma of dorsum, left side of nose as far as the upper lip. Spontaneous ulceration. Fifty mg. radium pure, screened by 1/10 mm. of aluminum applied for



Fig. 7.



Fig. 8.

four hours, at different portions of the involved surfaces. Each surface received from three to eight applications of the same amount of radium. After one and one-half years he was finally declared well. It is now over one year, and there has been no recurrence.

Case 4.—Female, age 46 years. Epithelioma of the lids,

secondary involvement of eye and orbital tissue of right side. Attending ophthalmologist was compelled to exenterate the orbit and remove both lids. The growth recurred. I applied 150 mg. of radium pure, screened by 1/10 mm. of

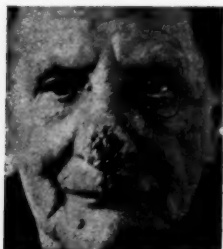


Fig. 9.



Fig. 10.

aluminum all over the cavity and margins for ten hours. Two months later all evidences of epitheliomatous structure was gone from the orbital cavity, but on two points at the inner canthus there was still evidence of suspected growth. (Fig. 7.) Fifty mg. of radium pure, screened by 1/10 mm. of aluminum, was applied for six hours. (Patient returned to her

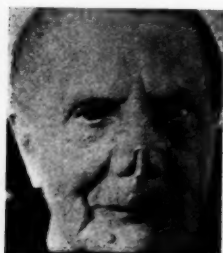


Fig. 11.

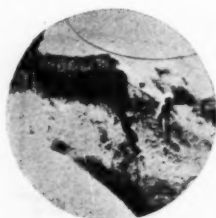


Fig. 12.

home and I have not seen her since.) Subsequent use of partial mask in Cases 2, 3 and 4, to replace the defects, is preferable to plastic operations for these old people.

Case 5 (Fig. 8).—Male, age 61. Microscopic and clinical diagnosis: Epithelioma of right inner canthus. Two erythema doses of X-ray treatment given within a period of nine weeks.

Not alone did the growth fail to diminish, but actually grew. The patient passed out of my hands.

Case 6 (Fig. 9).—Female, age 66 years. Epithelioma of the tip of the nose. Treated by X-rays for two months (type



Fig. 13.



Fig. 14.

of treatment not known). Stated that the growth was rapidly increasing. The growth protruded for half an inch. Patient refused to submit to anything else than the radical removal of the growth. I removed the growth wide of its margins by means of the Percy cautery. (Fig. 10.) After about two months the nose appeared healed. (Fig. 11.) Patient refused



Fig. 15.

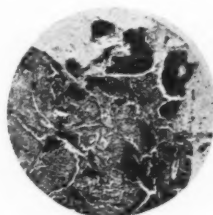


Fig. 16.

any kind of plastic cosmetic operation. Fig. 12 shows the growth to be a true epithelioma, very much inflamed and possibly changed by reason of X-ray treatment.

Case 7 (Fig. 13).—Male, age 71. Rhinophima with secondary epitheliomatous degeneration. The growth is seen to hang down over the man's lip and he was compelled to hold

it up by a sort of sling in order to be able to breathe, speak and eat. A thorough decortication with adaptation of the surrounding healthy skin in order to cover the raw surface, produced an excellent cosmetic and physiologic result. (Figs. 14



Fig. 17.



Fig. 18.

and 15.) The microscopic examination (Fig. 16) showed the typical histologic picture of hypertrophy of the epithelium, blood vessels, glands and connective tissue, but also in spots suspicious areas of an ephelioma. Consequently I had him X-rayed for three erythema doses within six months. He lived five and one-half years longer, dying from cardiovascu-

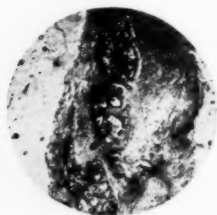


Fig. 19.



Fig. 20.

lar disease, with no recurrence or evidence of carcinoma in any other part of the body.

Case 8 (Fig. 17).—Male, age 46 years. Epithelioma of the lip. This was excised and the parts immediately approximated. (Fig. 18.) X-rays were subsequently employed for three erythema doses over the submental and submaxillary

regions (glands tributary to this region), as well as the operated area. There has been no recurrence now for over two and one-half years. Fig. 19 gives the microscopic proof of the epithelioma. It has been the rule and still is, in some of



Fig. 21.



Fig. 22.

the clinics, to remove the lymph glands and block from the submental region and make a greater sacrifice of the lower lip than in this case. This makes the operation much more formidable, causing considerable deformity of the mouth, and from observation of the cases treated like the one illustrated here it would appear that it was unnecessary. Time alone will

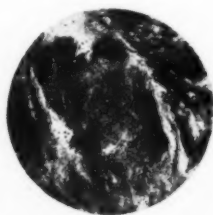


Fig. 23.



Fig. 24.

tell. The question also arises whether one may not treat the epithelioma of the lip simply with the X-rays or radium without surgery. Conflicting reports make me choose the procedure as outlined in this case. I have treated twenty-six cases of facial epithelioma similar to these illustrated, by means of surgery, X-ray, fulguration, carbon dioxid and radium,

and I must say that nothing will compare to the use of radium. Some of the early cases were operated upon several times and finally developed into true cancers with fatal results.

Case 9.—Male, age 45 years. Carcinoma of the anterolat-

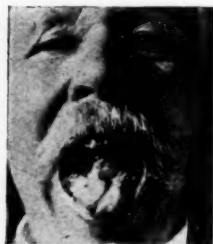


Fig. 25.



Fig. 26.

eral part of the tongue and that portion of the floor of the mouth (no photograph obtainable). (Operated away from home.) By means of a Percy cautery the growth was removed wide of its involvement. Lips and mouth were protected by speculum containing running cold water. Six weeks later the wound was healed and the tip of the tongue was fixed to the



Fig. 27.



Fig. 28.

floor of the mouth. (Fig. 20.) During the healing process a sequestrum came off due, no doubt, to the extreme heat of the cautery. This was a portion of the alveolar process of the lower jaw. (Fig. 21.) Patient's neck region was X-rayed for a period of two weeks, when he disappeared from observation. About two months later he returned with a recur-

rence in the neck (Fig. 22), but none at the site of original growth. Fig. 23 showed a typical alveolar carcinoma. The subsequent course of the case was rapidly developing metastatic condition, which caused the patient's death.



Fig. 29.



Fig. 30.

Case 10 (Fig. 24).—Male, age 53 years. Carcinoma of the base of the tongue and soft palate, tonsil and pharynx, also glands of neck. Preliminary X-ray treatment (one erythema dose to the neck) to attempt to block off further invasion of the lymphatics. Radical operation. Lived for about six

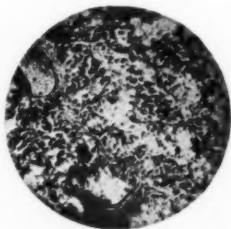


Fig. 31.



Fig. 32.

weeks, in a miserable condition; feeding possible only with a stomach tube.

Case 11 (Fig. 25).—Male, age 61 years. Microscopic diagnosis: Carcinoma of the half of the tongue. There were no glands of the neck present. Advised operation, removal of tongue. Patient refused operation. Under deep X-ray treatment the neoplasm grew to such proportions as to make breath-

ing impossible through the mouth or nose. A tracheotomy was performed. One hour after this the patient disappeared and was never traced with the aid of relatives and police.

Case 12.—Male, age 55 years. Suspected epithelioma of



Fig. 33.

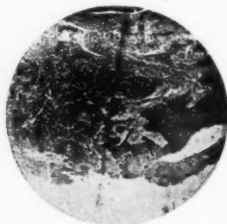


Fig. 34.

dorsum and lateral portion of tongue. No glandular involvement of the neck. Consulted the clinic at Johns Hopkins, and being a prominent physician from the South, he was given special attention by Dr. Barker, etc. A piece of the tissue was removed by them and diagnosed papilloma or nonmalignant growth. He received very intensive treat-



Fig. 35.



Fig. 36.

ment by radium (exact dose, etc., not stated in their report). Patient presented himself to me with two very agonizing symptoms, namely, hyperesthesia and excessive salivation. It was impossible for him to eat anything but the blandest food, and even this caused pain. There was a history of lues, although the Wassermann was always negative. The tongue looked

white and felt hard on the surface. There was an enlargement on the left side near the base (Fig. 26), with a distinct line of demarcation. I diagnosticated the condition as a radium burn and treated it as such. The line of treatment was

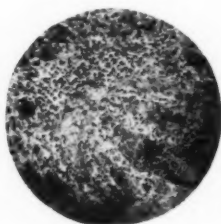


Fig. 37.



Fig. 38.

absolute rest to the tongue by insisting on feeding him with an esophageal tube and coating the tongue with various substances that could be made to stick, such as starchy pastes containing tragacanth. This was, however, without any lasting benefit. Atropin proved to be of most value. Recently he consulted the Mayos and more radium treatment was advised.

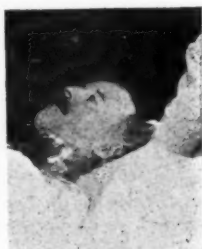


Fig. 39.

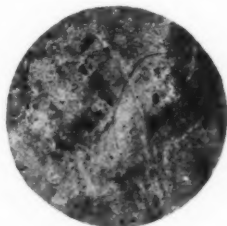


Fig. 40.

They believed that he had a malignant disease engrafted upon a luetic tongue. There were no enlarged glands present in the neck.

Case 13.—Male, age 58 years. Sarcoma of tonsil. Came to me with a severe radium burn of the right side of the base of the tongue and pillar and cheek. (Fig. 27.) The radium had

been applied by means of needles into a tumor of the tonsil microscopically diagnosed sarcoma. The growth had entirely disappeared when he presented himself to me and showed only a dirty slough within the tonsillar fossa. He gave a history of having been operated upon for peritonsillar abscess with pus discharge. The physician who made the diagnosis of sarcoma and had the radium applied had not seen any pus. The radium burn healed very readily following the application of bismuth subiodid powder.

Statistical: I have treated seventeen cases of carcinoma of the tongue, either surgically or combined with X-rays, radium, diathermia, cautery, etc. All the cases have succumbed to the disease or some immediate complication, bronchopneu-



Fig. 41.



Fig. 42.

monia and sepsis occurring in more than one case.

Case 14.—Male, age 60 years. Epulis in the left first upper molar. Transillumination and radiograms showed the greater portion of the antrum involved. (Fig. 28.) Sublabial operation, wide resection of the growth, removal of the greater portion of the superior maxilla. One hundred mg. of radium element, screened by $\frac{1}{4}$ mm. of silver filter, was placed into the cavity created by the operation and allowed to remain for twelve hours. The wound healed slowly, and in about two weeks a recurrence was observed. He was X-rayed intensively, but the growth progressed so rapidly in spite of this (Fig. 29) that a more radical procedure was decided upon, namely, total resection of the upper jaw (Fig. 30). Subsequent to this operation the patient received 50 mg. of radium screened as above, at periods of three days apart, for from three to

six hours. The recurrence was kept in abeyance and great hopes were entertained for his cure, but, as usual, after two months glands began to develop in the anterior and posterior triangle and nothing could stop the final fatal termination. Fig. 31 shows the microscopic section.

Case 15.—Male, age 52 years. Carcinoma of the upper jaw similiar to the one just described. A radical total resection of the upper jaw was performed; Figs. 32 and 33 show the end result, Fig. 34 the microscopic section. This case never received any X-ray or radium treatment, either before or after operation, and is shown as one of the cases to prove my contention in the introduction, that perhaps what we consider good treatment in the use of the X-ray and radium in car-



Fig. 43.

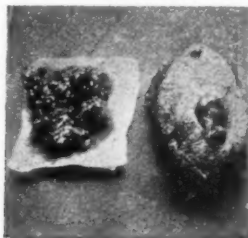


Fig. 44.

cinoma may be just the opposite. The patient is living, fourteen years after operation.

Statistical: I have had 19 cases of carcinoma of the upper jaw, all operated; most of them belonged to the inoperable type. In the majority, X-rays, radium, Percy's cautery or some other nonsurgical measure was employed in conjunction with operations. Only two cases lived and can be spoken of as cured. Most of the patients died from carcinoma metastasis.

Case 16 (Fig. 35).—Carcinoma of the larynx. Male, age 46 years. When I saw him first, he had a well developed neoplasm, but entirely within the larynx and confined to one side. Laryngotomy was performed and the growth removed, the wound being immediately closed except for the retention of a tracheal canula. Six weeks later he returned with a

marked recurrence. Laryngeal fissure was then performed, all the growth removed and the fissures opened for subsequent X-ray and radium treatment. This was instituted almost immediately after operation, but in spite of this fact recurrence was noticed, especially about the left posterior part of the larynx. During this intensive X-ray and radium treatment (16 mg., all that was obtainable at the time) pieces of the growth were removed at an average of once a week for microscopic examination as to control of the effect of the treatment. These sections clearly demonstrated slow but positive destruction of cancer cells. At the end of one year the laryngeal cavity appeared free from carcinoma, both macro- and microscopically (Fig. 36). Patient returned to his home



Fig. 45.



Fig. 46.

town, his physician reporting that there was no recurrence in situ, but he developed marked neurotic and neuritic symptoms, including pains radiating down the arm, chest and legs, so severe that morphin had to be administered. The neurotic symptoms were very peculiar and ordinarily would be considered as hysterical. They were so unusual and constant that I may be pardoned for mentioning them again in detail. "Always before a thunderstorm appeared he became very restless and panicky and insisted on locking himself in a dark room, until the storm passed. He would frequently do this twenty-four hours before the storm came on." These neuritic painful conditions usually followed such a nervous spell and the pain would center itself in the big toes. He died three years from the time I first diagnosed his case as carcinoma, or over two years after X-ray and radium were employed.

A postmortem examination was made, and no evidence of any metastasis could be found. I received the entire larynx and made a thorough macroscopic and microscopic examination, but could not demonstrate any carcinomatous tissue. (Fig. 37.)

Case 17.—Male, age 53 years. Came with a rapidly growing swelling on side of neck (Fig. 38). Examination within the throat and mouth revealed no primary growth. He was given deep X-ray treatment intensively, but the growth continued to increase until a tracheotomy was necessary. The tumor finally ulcerated (Fig. 39) and a microscopic section (Fig. 40) showed a typical carcinoma. The subsequent course was an early metastases into both lungs in spite of very active



Fig. 47.

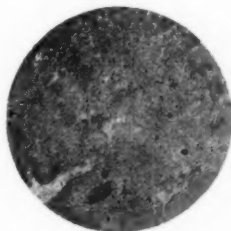


Fig. 48.

X-ray treatment, from which death ensued.

Case 18.—Male, age 47 years. Well advanced carcinoma of the larynx. A laryngofissure was performed and the growth thoroughly removed by the Percy cautery, allowing the fissure to remain open for after-treatment. (Fig. 41.) Within two weeks the fissure healed (Fig. 42). The interior of the larynx shows no evidence of any growth (Fig. 42). He left for his home in Wyoming. One month later he returned with an enormous recurrence, both in the neck as well as within the larynx, requiring tracheotomy. The neck tumor had broken down so as to appear like an abscess and this was opened and drained. Shortly after I removed a part of the mass from the neck, including the skin, which was involved in the process (Fig. 44). There remained, however, quite a bit of growth in situ (Fig. 45). This was now treated by

means of the surgical diathermia, as described by Nagelschmidt. At first it appeared as though this line of treatment would be effective, because the growth was shrinking and appeared healthy (Fig. 46). However, suddenly there occurred a marked change, and in spite of the treatment the growth spread very rapidly (Fig. 47) and caused great difficulty in breathing and swallowing. Suddenly one day he had a severe arterial bleeding that exsanguinated him and he died within an hour. Fig. 48 shows a microscopic section of a carcinoma.

Case 19.—Male. Was referred to me with a diagnosis of laryngeal carcinoma confined to the right cord. A microscopic section accompanied the patient. The physician as well as the



Fig. 49.



Fig. 50.

patient pleaded for intralaryngeal operation and nonsurgical measures should be given a trial. Consequently I performed a suspension laryngoscopy and removed what I thought to be the entire growth by that method. Subsequent to this operation the patient was given intense deep X-ray treatment over the thyroid region. The laryngeal condition appeared to heal very rapidly and his voice became quite clear. After the second erythema dose he developed marked symptoms of myxedema, which no doubt were due to the action of the X-rays on his thyroid gland. Therefore this line of treatment was discontinued, and he was put on large doses of thyroid extract, which corrected the myxedematous state. He then returned to his home in Vancouver, where he was observed by his physician (otolaryngologist). After nearly one year he was again sent back to me with a suspected recurrence

within his larynx. As he still insisted that he did not wish any operation upon the larynx externally, and was willing to take his chance on the former line of treatment, I removed all that I thought was diseased and had his larynx region X-rayed but not as intensively as the first time, as I feared to cause the myxedematous symptoms. This time, however, he did not improve; on the contrary, the growth took on a rapid development. At this time the patient agreed to an operation, and I found that laryngectomy alone could be of any value. This was performed under local anesthesia with very little difficulty. The usual technic differed in that I placed a dermal lined fistula (Fig. 49) subhyoidally to accommodate a tube which communicated with his trachea, making



Fig. 51.

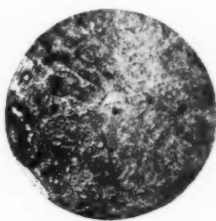


Fig. 52.

a sort of an artificial larynx (Fig. 50). Whenever he bent his head forward so as partially to kink this tube he could produce sounds that were quite audible and understood as speech. Fig. 51 shows the larynx, in which the growth extends anteriorly, but is confined within the larynx. Fig. 52 shows the microscopic section of a carcinoma. The patient again returning to the coast to be observed by his otolaryngologist, who reported about eight months later that the patient developed abdominal symptoms that proved to be due to cancer, from which he soon died. The larynx did not show any recurrence.

Case 20.—Male. Well developed neoplasm confined to the larynx. Microscopic examination (Fig. 56) proved it to be a carcinoma. A laryngeal fissure was performed and the growth removed wide of its development (Fig. 53). As soon as prac-

ticable an intubation tube carrying one hundred mg. of radium element, screened by a filter of 1.10 mm. of aluminum was inserted by way of the mouth and held in place by two threads (Fig. 54). These are tied over a piece of gauze, as suggested by Iglauder. The radium was removed after six hours, but the intubation tube was allowed to remain. These radium applications were repeated twice more within the next two weeks. The intubation tube was now left out and the fissure permitted to close (Fig. 55). Weekly inspection showed no recurrence for over two months, but at the end of that time a small growth appeared on one side which, however, was not at all influenced by either radium, X-rays or operation, and the usual termination of a metastasis and cachexia followed.

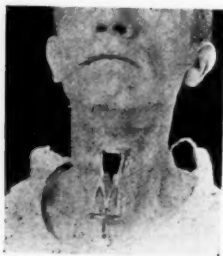


Fig. 53.



Fig. 54.

Case 21.—Male. Advanced carcinoma of the larynx, base of tongue and esophagus, upper part. Under local anesthesia I performed a tracheotomy. By means of pharyngotomy I removed a tumor mass, including the larynx, in the obliteration of the upper end of the trachea (purse string closure), base of tongue and the esophagus contiguous to the posterior portion of the larynx. A permanent esophageal intubation by way of the nostril was instituted, through which the patient was fed (Fig. 57). I wish to state that that was the most comfortable way of alimentation in such an extreme case under my observation. The remaining portion of the wound was closed by primary intention. The secretions that accumulated within the esophageal cavity were removed by the aid of suction. There were no X-ray, radium or other electrical measures employed. The patient made a splendid recovery

from the operation. Three weeks after the operation I removed the esophageal tube and allowed the patient to swallow liquids. On the third day, following this natural mode of feeding, the patient experienced while swallowing a glass of milk a sudden sharp pain in the middle of his back and into the neck. Within a few hours he developed classical symptoms of a septic mediastinum and died. Most probably the permanent esophageal tube caused a decubitus, followed by rupture during efforts of deglutition. It must be remembered that the base of his tongue had been removed, therefore swallowing was not normal. Fig. 58 shows the microscopic section of the carcinoma.

Case 22.—Male, age 60 years, had posttyphoidal laryngeal



Fig. 55.

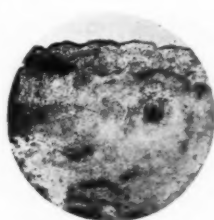


Fig. 56.

abscess when a young man requiring tracheotomy and incision of abscess. Twenty-six years later, after all the symptoms of the abscess had entirely disappeared, he developed a most rapidly growing tumor, both within the larynx and on both sides of the neck. It was somewhat indurated, and I thought that I had a case of Reclus' disease or woody phlegmon. A hurried tracheotomy had to be performed (Fig. 59), and at the same time I obtained a piece of tissue for microscopic examination, which proved to be a very active carcinoma (Fig. 60). I began the use of autolytic solution, obtained from fetal tissue, as recommended by Fichera and published by me (*ANNALS OF OTOLGY, RHINOLOGY AND LARYNGOLOGY*, March, 1912). The result was most gratifying, and for some time it appeared as if the growth was going to melt away, but liver metastasis appeared, with the usual ending.

Case 23.—Man, age 53, a public speaker for many years, with a hoarse voice for the past ten years, noticed in the last two months that this hoarseness was increasing.

Examination showed a unilateral swelling along the entire cord. Removal of a small portion and microscopic examination revealed a typical epithelioma (Fig. 62). An operation was performed under local anesthesia in the form of a laryngeal fissure, removal of the entire cord and considerable normal neighboring tissue. An immediate closure without tracheotomy or intubation was undertaken. There developed considerable edema within the larynx, causing embarrassment in respiration; however, this lasted only a day, when he began to breathe with comfort. Fourteen years later he still was



Fig. 57.

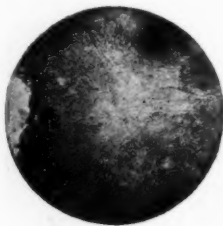


Fig. 58.

free from recurrence. He is an insurance man and requires a good voice, which he still has. He has some little difficulty when he swallows, characterized by a sort of pull on his thyroid cartilage, which is due to marked cicatricial bands developed in the healing (Fig. 61).

Case 24.—Man, for about six months has considerable difficulty in speaking and for the past month some slight embarrassment in breathing when walking fast.

Examination shows a unilateral growth of one cord which appears to dip under into the subglottic region. Under suspension laryngoscopy a small piece of tissue from the tumor was removed; microscopic examination showed it to be a typical quite rapidly growing carcinoma (Fig. 64). The physician referring the patient requested that if an operation was to be performed a preliminary application of a lethal dose of

radium, say 200 mg. of the element, be placed over the region of the larynx and allowed to remain for about ten hours. The term lethal had reference to the local destruction of the activity of the cancer cells so that in operating implantation carcinoma would be avoided. This is the advice of Wood and P——, New York, based upon experiments, and the physician mentioned above had more than five years' experience in cases where radium was employed.

Operation under local anesthesia. A thyrotomy was performed, and the growth was removed with considerable healthy neighboring tissue. A preliminary tracheotomy having been made, it was deemed advisable to allow the tube to remain for a day or two, especially so since two radium



Fig. 59.

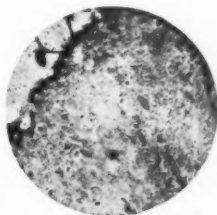


Fig. 60.

needles, each $12\frac{1}{2}$ m., were introduced into the wound caused by the excision of the growth. The patient exhibited unusual symptoms on the operating table, having several attacks of projectile vomiting, also being extremely nervous, although never complaining of pain. On being returned to his bed he showed symptoms of shock, from which he never rallied. He had very unusual toxic symptoms, which I could not quite understand, consequently called in an expert internist (physiologic chemistry), who was of the opinion, as was I, that the patient was suffering from a toxemia due to the massive dose of radium employed just before the operation. In less than thirty-six hours' time from the time of the operation the patient was dead in spite of all efforts. An immediate postmortem examination revealed locally an absolutely reactionless

area about the thyroid region (Fig. 63). No other post-mortem examination was performed.

Statistical: I have treated fifty-nine cases of cancer of the larynx, surgically alone or in combination with X-ray, radium,



Fig. 61.

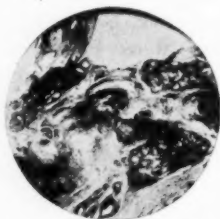


Fig. 52.

fulguration or surgical diathermia, Percy's cautery, galvano-cauterics, autolytic and colloidal solution. Also a limited number of cases in which only radium or X-rays were employed. Operative measures were intralaryngeal, both by indirect and by means of suspension laryngoscopy, laryngofissure, hemilaryngectomy, laryngectomy and extensive resec-



Fig. 63.

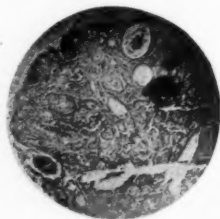


Fig. 64.

tion of glands and tumors of the neck secondary to the laryngeal growth.

Nine cases are alive, the longest since the operation, fourteen years. One case twelve years, one seven and one-half years, one six years and one five years and two months. The remaining four cases are between four years, and, the most re-

cent one, three months ago. These last four cases will not be considered cured until at least five years have passed without recurrence, either locally or metastatic. Strange to say, the oldest case which I have alive since operation was oper-



Fig. 65.



Fig. 66.

ated upon by the indirect laryngoscopic method. I see the man once or twice a year in order to keep him under control, and each time I review his microscopic section. The next oldest case, now twelve years, had a laryngofissure with immediate closure. The next two were laryngectomies, and the fifth a hemilaryngectomy and partial resection of esophagus,



Fig. 67.



Fig. 68.

but no glands. The four cases not yet considered cured because of the short duration were treated by laryngofissure or radium alone.

Case 25.—Epithelioma of auricle. Man, age 53 years. Two years before he was referred to me he noted a small swelling within his ear, which he had removed by a surgeon, who had

it examined microscopically and pronounced cancer. He recommended thorough surgical removal, to which the patient objected and consulted a "paste cancer cure specialist" in Iowa. He was treated just once. The ear became sore, then



Fig. 69.



Fig. 70.

healed and deformity resulted. (Fig. 65.) He was free from pain or recurrence for over two years. Now (1914) he notices a swelling in his neck and some pain in his arm. I found a recurrence within the external auditory canal and a mass on the side of the neck. I removed a piece from the canal which showed a true epithelioma (Fig. 66). I had him X-



Fig. 71.

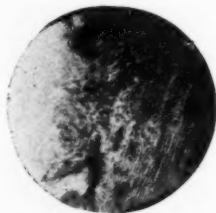


Fig. 72.

rayed for a period of six weeks without any special benefit, except perhaps the control of the pains. He finally consented to a more radical operation, which was performed by the excision of the growth within the canal and radical removal of the mass in the neck. He was subsequently rayed, but recurrence appeared almost immediately. The pains be-

came excruciating, even after the use of opiates. He went back to his home town, where he lived about six weeks longer and his physician reported his death from a gradual exhaustion with symptoms of esophageal involvement.



Fig. 73.



Fig. 74.

Case 26.—Man, age 51 years. A year ago had a small growth curetted from his external ear, followed by X-ray and radium treatment. There was a rapid recurrence and a marked swelling developed in his neck, as far as the clavicle. With this history, he was referred to me (Fig. 67) by Dr. Emil Beck, to whom he was recommended owing to the fact that he



Fig. 75.

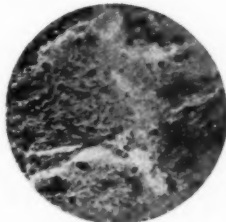


Fig. 76.

described a method of treatment of epithelioma and carcinoma for which this case was suitable. This method consists of the removal of all or as much of the growth as possible, including the overlying skin, fat and muscle, and subsequent X-ray and radium treatment. As many secondary removals of the growth as necessary are undertaken, so that the rays act

directly on the cancer without any screening or absorption of the beta rays by skin, muscle, fat or destroyed tumor. The work of Dr. Emil Beck is described in detail, including experimental work by G. W. Arner of the Ryerson Laboratory, University of Chicago, in surgery, gynecology and obstetrics. In October, 1919, I performed this extensive resection of skin, muscles and as much of the tumor as was safe, and left the area exposed for subsequent X-ray and radium treatment. Part of the pinna was sewed in for possible subsequent reconstruction. (Fig. 68.) The excised tumor mass is shown in Fig. 69, and Fig. 72 shows the microscopic section. It is a true carcinoma. He received seven erythema doses of X-rays within a period of nine weeks, also 40 mg.



Fig. 77.



Fig. 78.

of radium, screened by only $1/10$ mm. of aluminum and often the needles were unscrewed within the tumor. This combined treatment appeared to be of some benefit about the margins of the exposed area (Fig. 71), but the growth deeper down continued to develop so that more of the mass was removed, including the lower half of the auricle (Fig. 72). Shortly after this the patient developed difficulty in swallowing and hoarseness, also great pains in his arms and hand. Three months later, after a miserable existence on large doses of morphin, with but little relief from pain, he succumbed from exhaustion.

Statistics: I have had seven cases of epithelioma of the external auditory canal and auricle, of which three are living, one now eight years since operation, one three and one-half, and one seven months since he was discharged as cured. The

first one was operated upon and subsequently treated with X-rays. The second one was treated by carbon dioxid (snow) and radium, employing six seances of the snow and four applications of radium 10 mg., screened by $\frac{1}{4}$ mm. of brass, for one hour at each application. The third was treated by radium alone, 50 mg., screened by $\frac{1}{10}$ mm. of aluminum, for six sittings, each half an hour.

Case 27.—Man, age 27 years. Sarcoma of orbit. Received a slight trauma about one year before, which left a swelling above the left eye. About two months ago this swelling started to grow, and the last two weeks it grew so rapidly as to close his eye and cause considerable headache and pain. (Fig. 73.) A small section was removed and the microscopic exam-

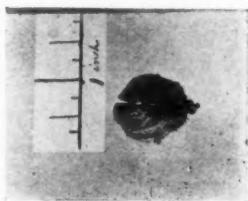


Fig. 79.



Fig. 80.

ination proved it to be a large spindle celled sarcoma. (Fig. 76.) He was immediately operated upon, and Figs. 74 and 75 show the condition just after operation. It was necessary to resect part of the orbit and temporofrontal bone, but the dura was not involved. It was not more than two weeks when he developed a recurrence. He was immediately put upon intensive X-ray treatment. In spite of everything that was done, Cooley's toxins, salvarsan, etc., he went from bad to worse and very soon developed an intracranial growth from which he died.

Case 28.—Woman, age 30. Melanosarcoma about the orbit. Referred to me with a growth on the inner canthus of eye close to the tear sac, also complaining of nasal obstruction, for more than three months. The growth has been rapidly developing for the past month (Fig. 77). It appeared very

dark in color, as though it was a very vascular neoplasm fixed to the bone. The eyeball was absolutely free from any involvement. Under local anesthesia the neoplasm was easily removed, including the periosteum, and left open for subsequent radium treatment (Fig. 78). Fig. 79 shows the size of the growth, and Fig. 82 its microscopic appearance—a small spindle and round celled sarcoma, numerous blood lakes and many masses of pigment. Immediately after operation 50 mg. of radium pure, screened by 1/10 mm. of aluminum and rubber tissue, was placed into the wound for six hours. Two weeks later two radium needles, each 12½ mg., were thrust into a mass which filled the greater portion of the left side of the nose and pushed the cartilaginous septum over



Fig. 81.

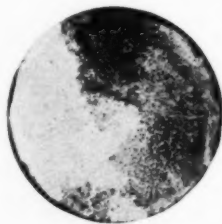


Fig. 82.

to the other side, and these needles were allowed to remain for four hours. Fig. 80 shows them in place. The area of the excised tumor practically healed and an ectropion of the lower lid developed. I now noted a small swelling in the upper inner corner of the orbit which felt elastic. Into this I thrust two radium needles of the same dosage as before, but only left them in place three hours. There now developed two radium scorches on the cheek from the first application which was kept from irritation by a gutta percha dressing (Fig. 81). At the end of six weeks the patient markedly improved in every way. She could breathe through the nose, the wound healed, the small mass in the upper inner corner of the orbit disappeared, and the radium scorch cleared up. She returned to her home for observation by her physician. One month later she returned with a swelling in her neck, and on

examination I found what appeared to be a gland, also some increase in the size of her alveolar process of the left superior maxilla. I removed the suspected gland and found it to be a very fleshy appearing mass, but I was able to remove it in toto without very much difficulty. The microscopic examination proved it to be a pigmented sarcomatous degeneration of the gland. I immediately placed her on deep X-ray treatment; March 21, 1920, two weeks after treatment, shows the swelling of her jaw and neck to be diminished rather than increased.

Case 29.—Male, age 37. Nasal sarcoma. Referred to me eleven years ago as an inoperable case, on account of rapidity of growth and profound anemia resulting from continuous



Fig. 83.



Fig. 84.

hemorrhages. The growth was protruding through the external nostril, apparently pushing the eyeball laterally, while the bridge of the nose was spread out and the hard and soft palate were depressed into the mouth. X-ray examination showed the both antra filled. Under local anesthesia I severed the nose, by a sublabial incision, from its attachment to the apertura pyriformis and the nasal septum, thus exposing both antra and both nasal cavities, which were filled up by the tumor mass. Bleeding was quite profuse. Retracting the face upwards, so to speak, made it possible to work fast. By means of an electric burr, the anterior wall of the antra was removed, and then a greater portion of the tumor mass was removed from the nasal cavity and the autrum on both sides. It was impossible to completely clear the nose on account of the loss of blood. The bleeding was stopped by packing and

the face brought down again and sutured by two stitches below the upper lip. This operation stopped the constant hemorrhages and patient rapidly gained so that six weeks later a second operation was performed under local anesthesia. This



Fig. 85.



Fig. 86.

time the nose was turned down by making a transverse incision across the root of the nose and severing the nasal bones and nasal process of the superior maxillæ. More tumor mass was removed, but again the operation could not be completed on account of hemorrhage. Figs. 83 and 84 still show the spread nose and depressed palate. Two months later I finally



Fig. 87.

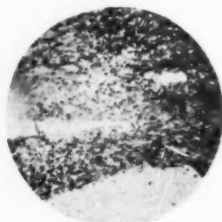


Fig. 88.

removed the remaining parts of the tumor (Fig. 85) by way of the natural nasal passage, which resulted in very free nasal breathing. The remaining tags of the growth were now treated by the aid of two radium needles each $12\frac{1}{2}$ mg., once a week for six weeks, when the patient was considered cured. It is now eleven years since treatment was begun, and over

a year since any recurrence has been observed. Figs. 86 and 87 show the appearance much improved. Fig. 88 proves the growth to have been a small spindle cell sarcoma.

Case 30.—Male, age 33. Sarcoma of palate and postnasal



Fig. 89.



Fig. 90.

space. For about three months this patient noticed a small growth on the inner surface of the alveolar process of the superior maxilla at the first molar tooth. (Figs. 89 and 90.) A piece of tissue was removed for microscopic examination and it proved to be a small round celled sarcoma. (Fig. 92.) Fifty mg. of radium, screened by 1/6 mm. of silver and cov-



Fig. 91.

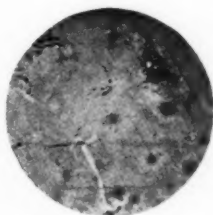


Fig. 92.

ered by rubber tissue, were properly applied by the radium expert and permitted to remain for six hours. I have never seen anything disappear as rapidly and the surface looked absolutely normal. Keeping the patient in Chicago for a few days in order to observe the condition, I noticed on the third day a very bright red colored spot to the side of his tongue

and cheek. The patient complained of a burning sensation which soon increased to pain, so that it pained him to eat anything. It was necessary to cocainize the tongue and cheek each time before eating. Fig. 91 shows an area of burn



Fig. 93.

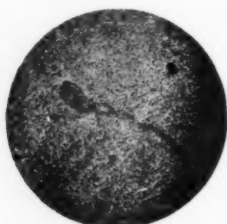


Fig. 94.

from the radium, and the radium expert (Dr. Wolpert) declared that the rubber covering of the radium capsule must have been defective and that we had a radium burn from secondary rays. He returned to his home city, where his physician reported to me that he had a great difficulty in eating. It was necessary to use cocain sprays and morphin.

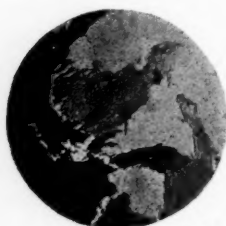


Fig. 95.



Fig. 96.

This pain or fear of taking food caused great emaciation. The surface of the previously existing neoplasm was fairly normal. One morning the doctor called in a hurry to the patient's home, and when he arrived found the patient had died. The family declared that he gave a sudden moan out of his sleep, breathed very laboriously and was blue in the face. No

postmortem was permitted and cause of death is unexplained.

Case 31.—Young man, age 19. (Fig. 93.) When a small boy had tonsil and adenoid operation performed. The adenoids were said to have returned and he was operated on a



Fig. 97.



Fig. 98.

second time. The same complaint of nasal obstruction was noted very soon after the second operation. Patient consulted another specialist, who thought he had a tumor back of his nose. Microscopic examination of a piece removed showed fibrosarcoma. When he was referred to me he had a mass very firm to the touch in the vault of the pharynx.



Fig. 99.

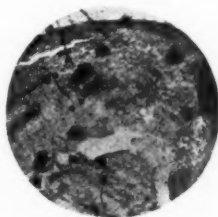


Fig. 100.

A piece removed for microscopic examination verified the previous examination. (Fig. 94.) A slight positive Wassermann reaction was reported. Antiluetic treatment had no effect, and in order not to lose much time it was considered best to reexamine by the aid of the microscope. (Fig. 95.) Two needles, each $12\frac{1}{2}$ mg., were thrust into the mass with

the soft palate retracted and a capsule containing 10 mg., screened by $\frac{1}{4}$ m. of brass and covered by rubber, was placed for three hours into the posterior portion of the left nasal cavity which was obstructed by the tumor. An exudate appeared the next day, and I made a microscopic section that showed it to be a very pronounced fibromatous meshwork with many leucocytes. One month later, patient returned to me and I found that more than one-half of the growth had disappeared and left a deep, sloughy surface. No treatment was applied; when he returned one month later the surface was clean. The remainder of the growth was now treated by thrusting two needles of $12\frac{1}{2}$ mg. each into it directly through the soft palate and allowed to remain for four hours. Fol-



Fig. 101.



Fig. 102.

lowing their removal there resulted a very brisk bleeding which required a postnasal tampon. This bleeding did not stop entirely after twelve hours of tamponade and another tampon was necessary. Patient again left the city for his home town, and his physician reported by letter that the boy was losing a little blood right along. The last inspection showed the growth to have practically disappeared, allowing nasal breathing and clearing the nasal tone to his speech. The surface, however, still bleeds when touched.

Case 32.—Man, age 62, came to see me with symptoms of a radium burn of his tongue, cheek and soft palate (Fig. 95). The history showed that he had a peritonsillar abscess, evacuation of which had been several times attempted. It finally ruptured spontaneously. Dr. Sonnenschein, who saw him after the rupture, suspected malignancy and removed a piece

of tissue which the laboratory reported as sarcoma. He had the radium expert put in two needles, each $12\frac{1}{2}$ mg., for six hours. Following this, the patient experienced great pain in swallowing, for which difficulty he consulted me. I found a whitish membrane on the inner surface of the cheek, anterior pillar of the tonsil and posterior lateral surface of the tongue on the right side (Fig. 96). Inserting an esophageal tube and allowing it to remain all day, he was fed through it, thus giving his strength which he lost from not taking any nourishment for several days owing to pain. The surfaces of the burn were covered with emulsion of scarlet red, which appeared to assist in the healing very much. In two weeks he was cured. There is no evidence of any neoplasm, and the



Fig. 103.

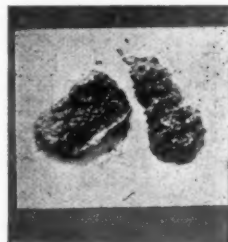


Fig. 104.

tonsillar area appears as though he had had a Pynchon cautery dissection of the tonsil.

Case 33.—Man, age 49, for the past six weeks had difficulty in breathing and speaking, but in the past week had two severe choking spells. Examination showed a firm tumor, apparently pedunculated, and attached to one side of the larynx, covering both vocal cords. Placing the patient in a recumbent position, head over the edge of the table, immediately relieved his obstructive breathing. Consequently I suspended him, and under local anesthetic (spray) removed the growth. A most distressing accident occurred which came near to causing the patient's sudden death during this suspension operation. While grasping the growth the Killian forceps cut through the pedicle, and in that moment the patient inspired and sucked the growth into the trachea. Fortunately, having

his lungs sufficiently filled with air, he made a violent effort to clear the trachea and the tumor hit me in the face. It certainly was a great relief to both the patient and myself.

The surface from which the growth was removed healed very rapidly, and the patient returned to his home city in less than a week very much encouraged. I was sure there would be a recurrence, because the microscopic examination of the growth proved it to be a large celled sarcoma. Less than a month later the patient returned with his larynx filled up so that he required an immediate tracheotomy. I decided to do a laryngotomy at the same time and remove as much of the growth as possible and anticipated subsequent radium treatment by way of the mouth (Fig. 97). This operation



Fig. 105.



Fig. 106.

proved to be of little value, consequently I reopened the larynx and treated the process through the external route both by radium and X-ray. Fig. 98 shows 100 mg. of radium properly screened, 1/6 mm. of silver and rubber. This was continued for six hours, every other day. Alternating with this treatment the patient received X-ray treatment. After two weeks he developed a marked erythema, so that all treatment was stopped. There was now no evidence of any growth, and the area that had been rayed showed marked effect like a burn (Fig. 99). The noticeable thing was the marked symptoms of absorption of that toxemia that I suspect is due to the destruction of radium and X-rays. He went back to his home and his physician reported that he lived only for about one month, dying apparently of absorption of poison and weakness.

Case 34.—Sarcoma of the neck. Female, age 51, noticed a small lump below her right jaw which was growing very rapidly (Fig. 101). I had her placed under the deep X-ray treatment, which had the opposite effect—it made the tumor grow (Figs. 102 and 103). I decided to try and stop this growth by operation, and by means of local anesthesia removed two large masses of characteristic sarcomatous tissue (Fig. 104) which proved to be microscopically a large spindle cell sarcoma (Fig. 108). The result from the operation was gratifying (Fig. 105). This result, however, did not remain very long; in fact, in less than two weeks there was a rapid reformation of the growth (Fig. 106), and in another month the patient was so weakened that she could not sit up, and the



Fig. 107.

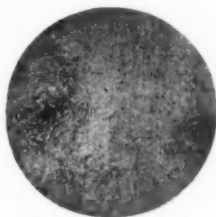


Fig. 108.

growth was enormous (Fig. 107). Other means, as Coley's toxins, were also employed, without the slightest benefit, the patient dying of exhaustion.

Case 35.—Sarcoma of the parotid. Female, age 23, a month previously noted difficulty in opening the mouth, with a tight feeling on the left side of her face. Suddenly the swelling appeared, which increased her pain (Fig. 109). A tentative diagnosis of retention in the parotid gland was made, but this had to be changed, as the swelling extended to the back of the neck. She was directed to use deep X-ray for six erythema doses, which was followed by disappearance of the swelling with all the symptoms. This, however, lasted only for about a month when the tumor returned with greater rapidity. It was now decided to operate, and so an incision was made retroauricularly (Fig. 110) and a fair amount of

the tumor removed, but not radically, on account of the large vessels and facial nerve. (Fig. 111.) She was again put on X-ray treatment, but the growth continued to develop until after four months the patient succumbed to a general toxemia



Fig. 109.



Fig. 110.

without any temperature. The microscopic diagnosis was that of a mixed cell sarcoma (Fig. 112).

Case 36.—Chloroma of the face. Boy, age 4. Mother noted a number of swellings about the face which made the skin overlying them look pale blue or green (Fig. 114). Routine blood examination gave me a picture that was most surpris-



Fig. 111.

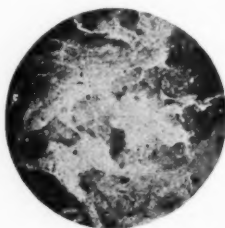


Fig. 112.

ing and led to the diagnosis. It was the following:

1. Leucocyte count, 210,000.
 - (a) Neutrophilic myelocytes, 38 per cent;
 - (b) Polymorphonuclear leucocytes, 40 per cent;
 - (c) Lymphocytes, 16 per cent;
 - (d) Eosinophiles, 20 per cent;

- (e) Large mononuclears, 10 per cent;
- (f) Eosinophilic myelocytes, 3 per cent.
- 2. Red count, 2,900,000.
- 3. Color index, .8.



Fig. 113.



Fig. 114.

He was immediately put on deep X-ray treatment and Fowler's solution, but the disease progressed uninterruptedly, and in less than three weeks he had the appearance shown in Fig. 113. It was very difficult to rouse him and there resulted a great emaciation and anemic appearance of the rest of the body. Terminal state was associated with subcutaneous

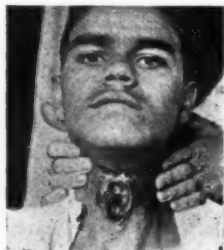


Fig. 115.



Fig. 116.

bleeding about the abdominal wall and the extremities. One large hematoma occurred in the quadriceps exterior on the right side. The child succumbed seven weeks from the time the mother noted the swellings about the face.

This is the only case of chloroma I ever saw. It is unfortunate that a microscopic section could not have been ob-

tained. The literature on this point shows the tumor to be a fibroblastic structure resembling a sarcoma, but instead of blood lakes there are actual blood vessels.

Case 37.—Papilloma of the larynx. Male, age 23, when seven years of age developed hoarseness, which persisted. The laryngologist of his home town diagnosed it papilloma and in conjunction with a general surgeon performed a thyrotomy and removed a mass of papillomatous material. He kept the larynx open for a long time, also a tracheotomy tube in place. When the larynx finally closed, he removed the tracheotomy tube and permitted its opening to close. It became, however, necessary to reinsert the tracheotomy tube in a day or two, the larynx having again filled up with papil-

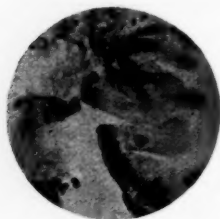


Fig. 117.



Fig. 118.

loma. For the next three years there was nothing done for the boy. At that time another laryngofissure was performed, the growths removed and the larynx again left open for some time for after treatment. When finally the larynx closed the tracheotomy tube was not removed. When he was presented to me, sixteen years from the time of his first operation, I found his larynx filled completely with a mass, and when the tracheotomy tube was removed it was found that the trachea had collapsed and patient could get no air. This was no doubt due to the low grade infection of the cartilage rings and subsequent absorption. It was decided, after a suspension laryngoscopy and removal of some of the tissue for microscopic confirmation, again to open the larynx, remove all the papilloma and then give him a massive dose of radium. Under local anesthesia the laryngofissure was performed, and it was

discovered that most of the thyroid cartilage was replaced by scar tissue. The growth was also much firmer than ordinary papilloma. Into the cavity created by the removal of all of the growth 100 mg. of radium element, screened by 1/10 mm. of silver, was placed and allowed to remain for eight hours. There resulted almost immediately a most profound toxemia, with marked symptoms of mental depression which never had been observed in the patient before. He refused food and talked of suicide. The wound itself was of fairly healthy appearance, although a great deal of discharge was present. (Fig. 115.) As soon as this diminished and the wound permitted, I inserted an up and down Jackson's laryngostomy tube which he wore for three weeks, when the trachea ap-



Fig. 119.



Fig. 120.

peared firm enough not to collapse. (Fig. 116.) The fissure will be kept open for some time to be sure there is no recurrence. He will finally have a plastic closure of the laryngostomy. Fig. 117 shows a typical papilloma with considerable round cell infiltration.

Note.—Six months later. His physician writes that the patient has regained his normal state of general health, and locally there appears no recurrence.

Case 38.—Boy age 7, when two years old had the first symptoms of laryngeal obstruction and hoarseness, which soon developed into severe choking spells, so that his laryngologist had to do a tracheotomy. This tracheotomy tube could never be removed or left out but for a minute, and at his presentation to me it had not been removed for over two years.

Examination. About the tracheal canula there was seen

a typical papilloma of considerable size. (Fig. 118.) I performed suspension laryngoscopy under vapor anesthesia and found the entire larynx filled with papillomatous masses. I removed as much as I deemed advisable and immediately inserted a hard rubber intubation tube which carried 25 mg. of radium screened by 1/10 mm. of silver. This intubation tube was held in position at the tracheal wound by means of a ligature as first suggested by Iglaue. The radium was permitted to remain for twelve hours, when he was reintubated without the radium. The following day 25 mg. of radium element screened by 1/10 mm. of silver was applied over the papillary excrescences about the tracheal opening and allowed to remain six hours. In less than a week the trachea was closed and



Fig. 121.



Fig. 122.

the intubation tube removed. (Fig. 119.) It appeared to be a striking result; however, the patient had some difficulty in breathing in the next day or two, especially when sleeping, so that I decided to reinsert a small tracheotomy tube and allowed him to return to his home city. The larynx remained free from papilloma and reports from his laryngologist are that he recovered completely, now over three years ago.

I have the records of thirty-nine cases of papilloma, principally of the larynx, of which sixteen cases received either X-ray or radium treatment in conjunction with operative interference. I am convinced that the best way is to treat the cases early, by intubation, the tube carrying the radium as described. When once the papilloma is of greater size and has lasted a longer time or perhaps has been previously operated upon, I think that operative interference, preferably by

suspension laryngoscopy, followed by radiation of radium, is best. The X-ray treatment of papilloma of the larynx has been anything but satisfactory to me, especially when the larynx is not opened. I have made several attempts with fulguration or surgical diathermia in cases but without satisfaction. I have the records of three cases of papilloma of the adult diagnosed by microscope, which were treated as such, but the subsequent course proved them to be malignant. Of course it is possible that a papilloma may become a malignant growth.

Case 39.—Lupus of the tongue. Male, age 25. For the past six or eight months noticed a hardening of his tongue, with nodular formations, especially towards the left side. Exam-



Fig. 123.



Fig. 124.

ination showed swelling and several hard nodules can be made out in different parts of the tongue. (Fig. 120.) After one course of X-ray treatments there was noticed a marked change in that the whole tongue softened. (Fig. 121.) After a rest of two weeks from treatment, I noted a very soft spot near the dorsum (Fig. 122), which finally broke down, discharging a yellowish material but containing nothing but contamination organisms. Following the healing of this abscess he was again subjected to a course of X-ray treatments. (The radiologist stated he was using a medium tube for fifteen minutes at each seance.) The tongue had a much healthier appearance, following this treatment. (Fig. 123.) Treatment was then discontinued because I noted a sort of a shrinking of the whole tongue. (Fig. 124.) Six months later he presented himself and the tongue looked smooth and more like normal. (Fig.

125.) The microscopic examination of a particle of tissue removed at the time of the ruptured abscess showed a granulation with no typical giant cells present. (Fig. 126.)

I have treated three cases of this nature, although one of



Fig. 125.

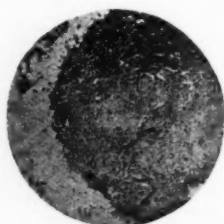


Fig. 126.

the cases no doubt was true primary tuberculosis of the tongue. In that case I had excellent results from the use of radium. It required two years to determine that the condition was cured. The end result was a tongue much deformed and restricted in motion. The third case is practically the same as Case 39, only that radium instead of the X-ray was employed.

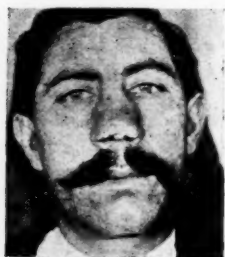


Fig. 127.



Fig. 128.

I employed from 10 to 20 mg. screened by 1/10 mm. of silver, leaving it in place one to two hours. These applications were made every three days. The case is still under treatment but progressing favorably.

Case 40.—Tuberculosis of external nose. Male, age 33. For two years noted a swelling about the tip of his nose, which

finally opened up and discharged. Examination showed a granulating mass in the columella of the septum and extending to the floor, where it was severed by the ulcerative process. (Figs. 127 and 128.) A piece of tissue was removed for



Fig. 129.



Fig. 130.

microscopic examination and found to be indicative of true tuberculosis.

He was put on X-ray treatment (daily), medium tube, ten minutes. It did very little good—in fact, the process continued to ulceration. I finally applied 30 mg. of radium element screened by 1/10 mm. of aluminum, and allowed it to remain



Fig. 131.



Fig. 132.

for six hours. Following this treatment there was a rapid improvement, so that in three weeks the nose was healed in scar formation as seen in Fig. 129. To correct the defect Dr. Carl Beck during my absence in France performed an Indian plastic operation which partially restored the cosmetic part of his nose. (Fig. 130.) I am now performing secondary

operations to help him to breathe through his nose as well as further to improve its appearance.

Case 41.—Male, age 29 years, presented himself to me with a swelling on the side of his nose and face, which finally broke

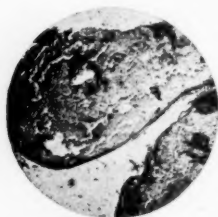


Fig. 133.



Fig. 134.

down at the alar region. (Fig. 131.) The interior of the right side of his nose was entirely blocked, and had the appearance of a luetic condition. A Wassermann was found strongly three plus, but the tissue removed was distinctly tuberculous and had a striking similarity to that removed from the nose of Case 40. (Fig. 133.) He was given several intravenous



Fig. 135.



Fig. 136.

injections of salvarsan and a thorough mercury and iodid medication, but with only partial benefit. Not until he received intensive X-ray treatment did the process finally heal. (Fig. 132.)

There are five true tuberculosis cases of nose which have come under my observation, all living, the longest fifteen years.

This case is recorded in Ballenger's textbook. It is interesting to note in connection with this case that the ultimate cure or nonrecurrence followed direct sunlight treatment brought in concentrated rays into the nasal cavity by the aid of a series



Fig. 137.



Fig. 138.

of magnifying loops catching sunlight and bringing it into concentrated form on the lesion.

The other two cases were subsequently operated on with actual cautery with the result of marked cicatricial contractions.

Case 42.—Blastomycosis of face. Rhinoscleroma of nose.



Fig. 139.

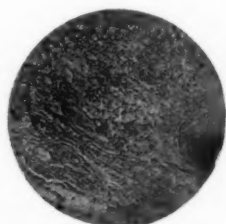


Fig. 140.

Tuberculosis of glands of the neck. Boy, age 14, for several months had an eruption about his face, especially the margins of his eyelids; all efforts of treatment by various physicians, including dermatologists and ophthalmologists, failed and the process was getting worse. Examination showed small ulcerations covered by dirty scabs. (Fig. 134.) When these crusts

were removed and slight scraping made from the ulcer, smeared and cultured (special media prepared) it was found to be practically pure blastomyces.

He was immediately put on X-ray treatment. He received six ten minute applications of the light tube when the face was healed and remained so. (Fig. 135.)

Case 43.—Male, age 46, suffered with nasal obstruction for nearly a year, during which period he has had several intra-nasal operations. He suffers considerable pain and headache. His general health has been very much affected by this condition and he appears anemic. Examination shows the external nose very much broader, especially at the root of the nose. (Fig. 136.) The entire nasal cavity on both sides is firmly



Fig. 141.



Fig. 142.

packed with the neoplastic structure. Looking into the throat, the postnasal space was found filled out with a mass which is verified by palpation. A piece of tissue was removed for microscopic examination, which bled very freely. The examination of this specimen justified, the diagnosis of large spindle celled sarcoma, with a very peculiar type of cells throughout the section. (Fig. 137.) It was decided to do a radical operation, and consequently I severed the external nose sublabially from the margins of the apertura pyriformis, and thus was enabled to remove all the growth from both sides of the nose very rapidly. Bleeding was considerable and hard to control. As a result of the operation there recurred a marked discharge. Examination showed the presence of a capsulated organism, the bacillus of Frish, and those peculiar cells seen in the section not previously recognized, the so-called Mikulicz

cells. The patient was immediately put on X-ray treatment and no recurrence followed. He went back to his home city, and I was subsequently notified that he succumbed probably to his secondary general condition rather than from the rhinoscleroma.

This was the first case of rhinoscleroma confined to the nose I have ever seen. I have treated four other cases of rhinoscleroma, all confined to the larynx, and aside from the dilation, intubation, tracheotomy and laryngostomy, they were also treated by X-ray and radium. I have observed that these treatments had a very decidedly beneficial effect on the local condition. Yet in all the cases it was necessary to use mechanicosurgical treatments as described above.



Fig. 143.

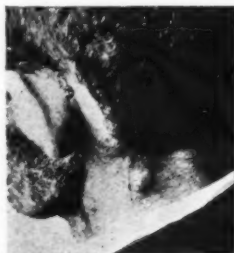


Fig. 144.

Case 44.—Young man, age 23, has had a unilateral swelling on the side of his neck for several months, recently becoming larger and giving him some pain. Examination showed a number of glands enlarged and matted together, extending from the lower jaw to the clavicle and almost the entire half of the neck. (Fig. 5.) The interior examination was negative, both tonsils and adenoids having been thoroughly removed. Removal of one gland revealed a true tuberculous change in it. (Fig. 140.) He was treated with deep X-rays, receiving three erythema doses within a period of four months. All but one of the glands disappeared. This one broke down and I had to open and drain it. Following this treatment the patient was and is cured. (Fig. 139.)

I have treated many such cases just this way, except that in most of them the work within the nose, mouth and throat

was of great importance to remove the original focus to prevent secondary infection of the tuberculous glands with pyogenic organisms. Very satisfactory results followed this line of treatment, and the radical resection of glands of the neck is practically unheard of in the large clinics in this country.

Case 45.—Neuroma of postauricular region. Man, age 52, for six months previous to his consulting a physician, noted a gradually increasing swelling below and behind his left ear. The surgeon who first saw him diagnosed the case as probable malignant growth of the parotid gland and operated for this. Two months following that operation the patient presented himself to me, with a recurrence of a semielastic growth at the angle of the lower jaw, which was associated with excruciat-



Fig. 145.



Fig. 146.

ing pains, locally as well as deep in the head and radiating to the vertex. I excised the growth down to the deep fascia. (Fig. 141.) The cavity thus created was left open for subsequent X-ray treatment, believing it to be malignant. A peculiar fact brought out by the operation was that the growth apparently had a capsule and the muscles were not infiltrated. Microscopic examination proved it be a true neuroma. (Fig. 146.) The wound healed very rapidly by the aid of a plastic, and the patient was apparently well (Fig. 142), but this only lasted three weeks, when another recurrence was noted with all the symptoms, only more severe. (Fig. 143.) Several separate nodules now appeared in the old operated field. (Fig. 144.) He was now put on intensive X-ray treatment, with the result that the growth increased, but the pain was affected somewhat, especially right after each treatment. (Fig. 145.)

I finally decided to do a Gasserian ganglion operation, having failed with injections of alcohol into the foramen ovale. The operation consisted in the resection of the posterior root of the ganglion. Two years later the tumors were much larger, but there was no pain present.

I have had a number of these and allied forms of neoplasms, some of which were treated in conjunction with X-rays, and I have never observed any marked beneficial changes from X-ray treatment alone. The control of the pain was about the best that could be said for it.

Case 46.—Paraffinoma of external nose. Female, age 23, being displeased with the shape of her nose, which from a photograph appears not to have been deformed (Fig. 147),



Fig. 147.



Fig. 148.

consulted an advertising quack (beauty parlor), who injected the bridge of her nose with paraffin. Two or three months later her nose began to pain her and showed a tendency to a bluish red discoloration. Shortly after that she noted that the mass injected was growing. She went back to him and he made an incision into it without any benefit. With this condition she presented herself to me, and I found that the mass was not confined to the place injected, but extended to the tip and side of her nose, with a small mass near the center of the forehead. Large blood vessels traversed the overlying skin. (Fig. 148.) Wishing to determine the histologic nature of the growth, I excised a small mass from the center (Fig. 149), which I allowed to remain open. I made a very interesting observation while dressing the wound, namely, an oozing out of paraffin proven microscopically. The swelling in

the center became much smaller and less red, whereas the sides were growing and extending into the orbital cavities and side of the face. (Fig. 150.) She had a great deal of pain in the infiltrated parts, as well as radiating pain. The later conditions were not at all influenced by X-ray, radium or any other applications, consequently I determined to operate—that is, radically to resect all the paraffinoma possible. Under general anesthesia, because it was impossible, either by local infiltration or ethyl chlorid spray, to anesthetize the parts, I dissected the apparently healthy overlying skin to either side, as well as over the forehead (Fig. 151), and with considerable difficulty dissected out a number of fibrous masses. (Fig. 15.) These microscopically examined showed atypical paraf-



Fig. 149.



Fig. 150.

finoma in the proliferation stage—that is, many new blood vessels forming throughout the tumor, rapidly obliterated by active growth of connective tissue about these vessels. This connective tissue acted differently from the usual inflammation. (Fig. 153.) Readapting the dissected flaps of skin, they were held together by two or three horse hair stitches. They healed very promptly, as shown in Fig. 154. There remained a central defect which healed by cicatrization. The subsequent course is very interesting in that a slow regrowth may be observed which, however, is not associated with pain. I am employing 10 mg. of radium element, screened by $\frac{1}{4}$ mm. of aluminum for one hour every day, over different areas involved, and can see some effect from the treatment. The final result will be most interesting.

I have had one other case that approached anything like the

one described. It is illustrated in my chapter in Loeb's *Operative Surgery of the Nose, Throat and Ear*. That case terminated in suicide. I have seen a number of ugly paraffin masses injected for cosmetic purposes, but not that grew like the two reported.

Case 47.—1. Leucoplakia of the tongue. 2. Lymphoma of the tongue. Female, age 41, had observed a white spot on the side of her tongue for about a year, which came shortly after she had some teeth drawn on that side. (Fig. 155.) Recently this white spot increased, consequently she consulted a physician, who diagnosed the condition. Fearing the possibility of a carcinoma developing, he referred her to me for radium treatment. I found that the healed alveolar process



Fig. 151.



Fig. 152.

of the lower jaw had a very sharp edge, and when the mouth was closed the affected portion of her tongue came directly over this sharp edge. (Fig. 156.) Therefore I concluded that this was a case of decubital necrosis. I correspondingly advised her dentist to make a hard rubber plate (Fig. 157), which would prevent the tongue from coming in contact with this sharp edge of the jaw. At the same time I applied 10 mg. radium element, screened by 1/10 mm. of silver for one hour, every three days. This was held against the tongue by the dental plate. After two weeks there was nothing seen on the tongue.

Case 48.—Man, age 33, presented himself on account of a swelling of his tongue, which had been present for about two months. There was a great deal of itching in his tongue, causing him to consult a physician a week previous, who in-

served a red hot electric needle into the tip. Examination revealed a triangular area of ischemic tissue at the tip, with a central dark spot; within twenty-four hours there was a line of demarcation of a slough. (Fig. 158.) At this time he com-

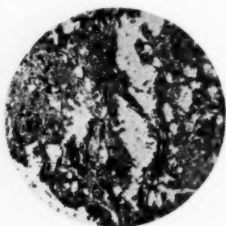


Fig. 153.



Fig. 154.

plained more of inability to swallow, and the whole of the tongue felt boardlike and his tonsils like two tumors, almost shutting off the breathing. There was no evidence of pus or even inflammation. The patient was very pale, and the blood examination showed a picture of a secondary anemia. There was a leucocytosis present. The process of necrosis of the



Fig. 155.



Fig. 156.

tongue rapidly progressed and completely sloughed off at the tip. (Fig. 159.) I have had his tongue X-rayed, and to my astonishment there was a marked effect on the healing of the tongue ulcer, as well as a reduction in size of the tongue as a whole. (Fig. 160.) The swelling of the tonsils was also markedly reduced. He was given a general X-ray treatment,

arsenic internally and blood transfusion. For a day or two it looked as if he would recover. However, there was a sudden change for the worse, marked cerebral symptoms of anemia developed and he died. A section taken of the tongue



Fig. 157.



Fig. 158.

immediately after death showed microscopically a marked lymphocytic infiltration throughout the substance of the tongue. (Fig. 161.)

This is the only case of this type that I have seen, but I have had eleven cases of Hodgkin's disease, in which the tonsils were markedly enlarged, with symptoms to some extent



Fig. 159.



Fig. 160.

referable to the tongue. All these cases received X-ray treatment and also the other customary general treatment. The tonsils, like the glands in the neck, were beneficially influenced, but all the cases finally died.

My records show that I have seen and treated eighteen cases of marked leucoplakia of the tongue alone, and seven addi-

tional cases of tongue and cheeks. Nothing has ever affected them better than radium applications. Antiluetic treatment was absolutely of no value. X-ray was of some value, but I do not recall a single case that was permanently cured. I

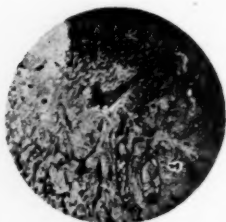


Fig. 161.



Fig. 162.

have seen four cases develop into an epithelioma, and one case very rapidly destroyed a patient's life by metastasis of a jaw cancer. Discontinuance of smoking had some effect on the denseness of the patches.

Case 49.—1. Chronic deep neck abscess, or woody phlegmon. Suspected malignant disease. 2. Perichondritis of the



Fig. 163.

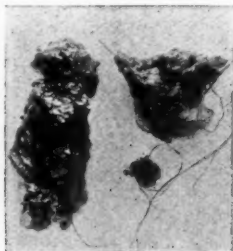


Fig. 164.

larynx. 3. Scleroderma involving larynx. Male, age 53, was referred with a swelling of the left side of the neck, located below the lower jaw and extending backwards to the occiput. It was hard, not painful, and had a somewhat inflamed skin surface which was adherent to the underlying mass. He gave a history that he had a mastoid operation three years before

this swelling appeared. There was no evidence of any focus of invasion in the nose, mouth or throat. Removing a piece of the mass for microscopic examination, the wound was left open for X-ray treatment. (Fig. 162.) The mass was then

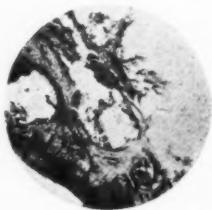


Fig. 165.



Fig. 166.

X-rayed by deep penetrations for one erythema dose, but no appreciable difference was noted following this. The microscope revealed the growth to be inflammatory. Patient being a physician, was anxious to return to his western home, and urged me to remove the mass by radical surgical procedure. To this I acquiesced, and under a general anesthesia removed



Fig. 167.



Fig. 168.

all I was able of the mass (Fig. 164), being compelled to liberate the vital structures of the neck, as the carotid artery, internal jugular vein and pneumogastric nerve. In the dissection there were areas that appeared suspicious, consequently I permitted the wound to remain open for subsequent X-ray treatment. I prepared a flap of the overlying skin,

which I hoped to use in covering the wound, after being certain that there remained no cancerous tissue. (Fig. 163.) Examination of the resected mass at various points showed nowhere any microscopic evidences of malignant disease, only

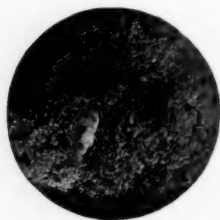


Fig. 169.

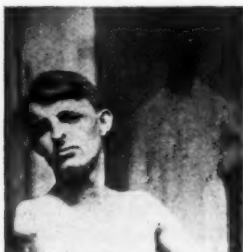


Fig. 170.

chronic inflammation with areas of necrosis. (Fig. 165.) The day following the operation, the wound discharged unusually much, and the discharge escaping over the healthy skin of the chest and shoulder caused a marked pustular formation. Examination of the pus showed a pure culture of a diplococcus. On the third day after operation there appeared a most dis-



Fig. 171.

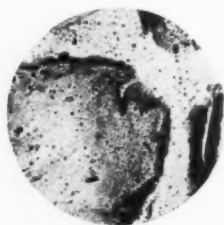


Fig. 172.

agreeable complication, namely, a softening of the internal carotid artery, threatening rupture. I immediately ligated low down near the sternoclavicular articulation. However, I did not shut off all the blood at once, not wishing to produce cerebral anemia. The same day the softened arterial wall ruptured with a very free bleeding, but the nurse stopped it by

hard pressure until I was able completely to ligate the artery. Following immediately this ligation he developed a hemiplegia on the right side. He lived for two more days, dying, I believe, from weakness due to the shock and hemorrhage.



Fig. 173.



Fig. 174.

I believe this patient had originally a Bezold's mastoiditis with a sinking abscess of the neck. This remained chronic, the organism being inactive during all that time, but becoming very active under the influence of the X-ray and operative intervention. The extreme lytic action of these bacteria



Fig. 175.

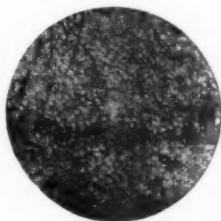


Fig. 176.

I believe was responsible for the softening of the arterial wall and other complications. The lesson to be learned from this case is that the so-called woody phlegmon or chronic cellulitis should never be subject to radical operation. I have observed several cases of this woody phlegmon and have treated them with X-rays. Two of these became malignant, the

patient succumbing to the disease, however, more slowly than in the usual secondary neck carcinoma.

Case 50.—Male, age 62 years, was referred to me as a case of cancer of the larynx for radium treatment. He had considerable difficulty in breathing and his voice was much affected. Clinically it had the appearance of a carcinoma of the larynx.

Desiring to remove a piece of tissue from the larynx for microscopic examination as well as to introduce an intubation tube loaded with radium, I attempted to do a suspension laryngoscopy, but this was impossible on account of his struggles for air. Consequently a tracheotomy was performed. The examination of the microscopic examination was negative as



Fig. 177.



Fig. 178.

to cancer, and all it showed was an inflammation. (Fig. 167.) Patient received, on general principles, a crossfire application of radium element 25 mg. on the intubation tube and 100 mg. on the outside of the thyroid cartilage on the left side where the suspected malignant growth was located. The screening at the intubation tube was 1/10 mm. of aluminum, whereas outside there was a screen of silver 1/4 mm. The radium was left in position for six hours. The immediate result on the breathing was good, but I considered it due to the mechanical effect of the intubation tube. Patient went back to his home town and his otolaryngologist reported to me that there appeared to be a steady progress for the worse. Three weeks later he returned and there appeared to be a marked increase both within the larynx and externally. Another piece of tissue was removed from the larynx and examination was again re-

ported negative as to cancer. It was inflammatory; nevertheless, I advised a thyrotomy. On dissecting down on the swelling, my associate, Dr. Pollock, noted a sort of a fluctuation of the mass. Incision permitted the escape of a large quantity of thick pus, which contained very few microorganisms. This abscess was drained and the thyrotomy postponed. (Fig. 166.) The result now was striking in that the intralaryngeal growth entirely disappeared, and the patient began to gain in strength and voice. However, there recurred a most distressing and wholly unexpected complication. About two weeks after operation the patient had a chill, followed by high temperature (105°), evidences of swelling about the abscess cavity and a very septic appearance. From that time on for about



Fig. 179.



Fig. 180.

six weeks he had repeated chills and rises of temperature with a gradual loss of vitality, so that he finally succumbed to that complication. The wound itself did not demand any surgical interference and there was no doubt that the infection got into the system through the internal jugular vein. Ligation would have been the proper thing, but the patient was not a good risk for any operation.

I have seen not less than twenty-five cases of similar character that had all the clinical appearance of carcinoma, but later showed abscess; most of these cases are syphilitic perichondritis in the old. At present I have two cases of this form that are tuberculous in nature. The microscopic examination, however, reveals simply an inflammatory process not characteristic of either lues or tuberculosis, nor is there any other characteristic, physical or blood finding.

Case 57.—Male, age 43, for more than two years noted a scar formation in his skin all over the body, especially about the face, hands and feet. These scars contracted and produced a crippled condition of his hands and fingers, toes and eyelids. (Fig. 168.) He also noted that his voice and breathing became difficult. Examination of the larynx showed contraction and thinning of the mucous membrane. It became necessary to open the larynx to relieve these symptoms. A piece of tissue from within the larynx showed under the microscope it was purely connective tissue of chronic variety. (Fig. 169.) The thyrotomy was kept open for a long period (several weeks), during which time the patient received X-ray and radium treatment. The result was very satisfactory and he recovered



Fig. 181.



Fig. 182.

a fair voice and good breathing. The body as a whole received X-ray treatment with benefit. It must be added that large doses of thyroid extract was given during his stay at the hospital and after he left.

Case 52.—Keloid about the face. Man, age 26, while crossing an elevated railroad, tripped and fell on the third rail, which was highly charged with electricity. The accident caused a severe burn about the face and arm, necessitating the amputation of the arm. The resultant deformities from the loss of the *alae nasi*, part of the upper lip and lid are shown in Fig. 170. The scars were distinctly keloid in character, and their removal was always followed by recurrent keloid. Fig. 172 shows a typical section of such scar formation, with the unusual hypertrophy of the epithelium covering the scars. I finally had applied X-ray and radium over these keloid areas,

using always a screen of aluminum and leaving it in situ for two hours. Subsequent to this sort of treatment, I noted a softening of the scars, but the best thing noted was the non or slight reformation of the keloid after plastic operations of correcting the ala, lip and lid. (Fig. 171.)

I have treated a fair number of keloids about the face and have found nothing approaching the value of radium applications. From the X-ray I have not seen very much benefit, and surgically there is usually a failure, no matter how carefully one approximates the skin incisions. The internal administration of thyosinamin is perhaps of some value. I make use of it in every case.

Case 53.—Thyroid gland. A. Hyperthyroidism and exoph-



Fig. 183.

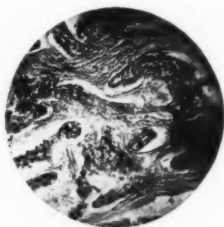


Fig. 184.

thalmus. B. Lipoma. C. Malignant disease. Man, age 27, for more than a year has been suffering with nervousness, headaches and weakness and for the past month can scarcely walk. Also noted a swelling about his neck and a bulging of his eyeballs.

Examination shows a typical extreme thyrotoxic state with all the signs of a markedly progressed case. (Fig. 173.) He was immediately placed on appropriate X-ray treatment, with the result that within six weeks I could remove his tonsils, devitalized teeth and ligate the superior thyroid arteries. He recovered completely without any further thyroid operation.

Case 54.—Woman, age 48, has had for more than a year all the classical symptoms of hyperthyroidism, but no glands enlarged. The most marked symptom was the exophthalmos. (Fig. 180.) After seven erythema X-ray doses, it was noted

that we could attempt to remove the various points of chronic infection. Consequently her tonsils and teeth were removed, and practically all her thyrotoxic symptoms disappeared, but the exophthalmos remained the longest—in fact, they never went back to normal. It was, however, noticed that whenever she received a diathermic treatment to the neck (over the region of the sympathetic ganglion) there was a temporary recession of the eyeball, as proven by the exophthalmometer.

I have treated many cases of thyroid gland disease not thyrotoxic, adenomatous and colloidal degeneration, and have observed but very transient benefit. However, the toxic symptoms were always favorably influenced.

Case 55.—Female, age 8. Mother noticed that the daughter



Fig. 185.



Fig. 186.

developed a swelling in the center of her neck, which for the past two months was growing. It caused no other symptoms. Examination revealed a soft nonpulsating tumor that extended from the thyroid cartilage below the sternal notch and quite a ways laterally. (Fig. 174.) Believing it to be a thyroid gland enlargement, she had received adequate X-ray treatment for three erythema doses without the least particle of effect. Consequently I operated and found a lobulated tumor indicative of lipoma. (Fig. 175.) The microscopic examination showed it be a lipoma. (Fig. 176.)

Case 56.—Female, age 59, had a neck swelling for several years, but recently it began to grow quite rapidly. She consulted a physician, who attempted to remove the growth, but the patient stated the doctor said he had to desist on account of uncontrollable hemorrhage. When she presented herself to

me there was a hard nodular swelling extending the whole anterior part of her neck, causing considerable difficulty of swallowing. An old scar bisected the swelling. (Fig. 177.) Suspecting a malignant growth, either sarcoma or carcinoma, I had her given treatments, but after five erythema doses there was not only no benefit, but she became worse, especially in her breathing, so that I had to perform a tracheotomy. This was accomplished with considerable difficulty, because I had to plough through a very bloody tumor. I performed practically the whole operation with the Percy electric cauter, thus minimizing the bleeding. The patient lived fairly comfortably, so far as breathing was concerned, for about one month, but she lost rapidly in weight because she could not



Fig. 187.



Fig. 188.

swallow. She refused a gastrostomy. The microscope demonstrated a highly vascular epithelial growth.

Case 57.—Female, age 61, had a large neck for many years, but noticed that during the past six months it grew more rapidly and became hard and nodular. She also had difficulty in breathing. (Fig. 6.) Suspecting malignant change, I had her treated by intensive X-ray for three erythema doses, but with no appreciable result. Desiring to relieve the pressure upon the trachea by lifting the gland away, I placed the patient on the table for a local operation. I had barely injected two drachms of apothecin and made the incision when the patient developed marked nervous symptoms, a very rapid heart beat, general tremors and vomiting, which I could not control. There developed a marked acetone breath, and in

spite of all my efforts she died in less than twenty-four hours from symptoms of exhaustion.

Case 58.—Female, age 63, always had a swelling of her neck, but quite recently it began to grow very rapidly, so that when she presented herself for examination she could scarcely breathe or swallow. She had been for several weeks under the treatment of a competent physician, who said she received ray treatments without any benefit.

There was a very hard nodular mass practically surrounding the neck. (Fig. 179.) Attempts to intubate her with a stiff rubber catheter were futile, and since there was no time to lose I attempted to cut down to her trachea. In the attempt of going through a mass of soft, excessively bleeding tissue to the trachea, I found myself embarrassed by inability to stop the bleeding except by pressure, and when doing this I shut off her breathing entirely. In a frantic effort to reach the trachea I finally did open it, but the patient was exsanguinated and died on the table. I made an immediate post-mortem and found that the growth had extended into the mediastinum.

Case 59.—Female, age 9. (a) Lymphangioma of lip. (b) Hemangioma of face and tongue. (c) Varices of the tongue. Ever since she was a little baby the parents noticed a swelling of her right upper lip, which had periods of enlargement and recession. Figs. 181 and 182 show the patient when she presented herself to me. It had a fairly firm doughy feeling and was not painful. Puncture revealed nothing. Suspecting a lymph vessel growth, I had her placed under X-ray treatment, which had absolutely no effect. I then put on 50 mg. of radium element, screened by $\frac{1}{4}$ mm. of silver, for four, five and six hours, respectively, within two months. After a month of waiting I noted but very little change for the better, consequently I excised an encapsulated growth, following which I had a very good cosmetic effect. (Fig. 183.) The microscope verified my clinical diagnosis of lymphangioma. (Fig. 184.) There were many changes of an inflammatory character, which probably were due to the X-ray and radium treatment.

Case 60.—Child, age $1\frac{1}{2}$. A few days after the baby was born the mother noted a small red spot about the right upper

eyelid and this grew so rapidly that within a month the entire eyelid was involved. Various treatments were tried by the family physician, but nothing appeared to stem the progress. When I saw it, the appearance was as in Fig. 185. I decided to try out various modes of treatment, selecting the different portions involved and confining the particular treatment to that part. I applied the carbon dioxid snow over the area of the forehead. The eyelid I treated with 10 mg. of radium element, screened by $\frac{1}{4}$ mm. of aluminum. The cheek I injected with boiling hot water, the upper lip with X-ray, and the outer part of the cheek, ear and neck with minute ligations subcutaneously placed. The result, after very uphill and persevering treatment for nearly one year, was the complete disappearance of the growth, leaving a healthy but much scarified face. (Fig. 186.) The eyelids which received the radium treatment gave the best cosmetic and physiologic result. She had more than twenty applications of radium, always an hour duration, and there remained a perfectly transparent cornea. It is my intention when I am sure there will be no recurrence to do a facial plastic operation on her.

Case 61.—Male, age 64, complains of thickening of his tongue, especially on the sides. This condition has been in existence for the past two years, gradually getting worse. Examination shows a marked dilatation of the veins from the tip to the base, extending towards the floor, on either side. (Fig. 187.)

The base of the tongue veins were equally dilated. I could find neither a local nor general condition explaining this condition. Application of 25 mg. of radium, screened by $\frac{1}{10}$ mm. of aluminum, and well covered by rubber tissue, placed between the tongue and floor of the mouth for six one-hour periods caused a marked diminution in the size of the veins.

The base of the tongue showed no particular change.

Case 62.—Baby, age 2 years, was born with a blue tongue, which gradually grew until there was not room enough within the mouth, and it protruded. (Fig. 158.) There were no great difficulties in breathing, but some trouble in feeding. Following one application of X-ray for 15 minutes by a medium tube, the tongue grew so rapidly that it became necessary to retract the cheek to allow air to pass for breathing.

The nasal breathing appeared to be shut off by pressure against the soft palate. The child weakened so rapidly and nothing could be done to stem the tide. It died in less than a week from the time the X-ray treatment was given.

I have treated eighteen cases of angiomata about the head and neck with very satisfactory results by various methods as indicated in the case. There is no question that the radium is the best means of treating it, especially if one has the larger plaques to apply over greater areas.

CONCLUSIONS.

1. Comparing cases treated before radium and the X-ray were in vogue, I find my records show a higher percentage of cures of malignant disease when these were not employed. This is contrary to the general belief.

2. There appears to be a toxemia develop in cases of malignant disease wherein large doses of radium and X-ray are employed which differs from the ordinary toxemia found in cancer or toxemia from X-ray and radium in nonmalignant disease. I am trying to determine if in the chemistry of the blood there could be isolated a substance and possibly prevented or neutralized. I have asked Dr. Gradwohl to assist me in determining this fact, and he has already shown me that one substance appears to be increased in the blood following treatment of malignant disease by means of massive dosage of radium and X-ray.

3. The earliest possible diagnosis of malignant disease with as thorough early operation without X-ray or radium treatment, either before or after operation, would be, in my judgment at the present, to the best interest of the patient.

4. I fully realize the greatness of X-ray and radium as to the possibilities of curing malignant disease, but thus far in my experience of nearly sixteen years, it has not demonstrated this value.

5. Realizing the great possibilities, I shall continue to experiment with them as well as any other substance or mode of treatment that promises at all any possibility of a cure of cancer.

6. As stated in the beginning of the paper, following up the cases and re-reporting on them is of the utmost importance.

7. In nonmalignant conditions there should be every effort made to determine the value of X-ray and radium, because there is everything to be gained and nothing lost but time. There are exceptions, as, for instance, thyroid gland enlargements without toxic states have been often treated by X-ray, procrastinating until these symptoms appeared.

8. The proper technic of applying X-ray and radium is essential; furthermore, the technic employed should be reported.

NOTE.—Since the presentation of this paper, more than a year ago, a number of cases here reported have undergone marked changes, and many new cases have been observed, upon whom the radium treatment associated with operation was employed. It would be well if I were able to amplify this article by reporting these cases, but there is neither time nor space at the present for such a publication; it will, therefore, be reserved for a future occasion. I have learned one or two very important facts which do not appear in the paper in regard to the mode of application of the radium needles. I refer to the danger of causing marked destruction in the close proximity to the radium needle applied within the center of the growth, and if at the same time there is a stimulating action of the radiation from the center to the periphery of the growth. Therefore in the employment of radium needles or, for that matter, any other applicators, it is best to treat from the periphery to the center. Another observation that is important is that while one may demonstrate microscopically true cancer cells in cancer areas treated by radium, I have noted in a number of instances that no regrowth occurred from these for a period of nearly a year. Are we to assume that such cancer cells are innocuous? Time only will tell.

I have treated a number of cases of malignant diseases of the upper respiratory tract with radium only, and without operation, and in several instances most remarkable results were noted. How permanent these will be again only time will tell.

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XXII.

THE TONSIL QUESTION—RELATION TO DUCT-
LESS GLANDS—FUTILITY OF OPERATIVE
INTERFERENCE IN THE EXUDATIVE
DIATHESIS TYPE OF CHILDREN.

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The modern tonsil operation had its birth twenty centuries ago, and to Celsus one must give the credit of performing the enucleation with his finger.

History does not tell us why the complete enucleation operation went into the discard, but it lay there in a state of "innocuous desuetude" until it was resurrected by the late Dr. John Farlow of Boston, thirty-odd years ago. Apparently progressive Boston did not follow in Farlow's footsteps, and it remained for Chicago to relocate the operation, and it fell to Dr. Chas. M. Robertson to describe a new method of removing tonsils at the New Orleans meeting of the American Medical Association in 1903.

It was my privilege to meet Dr. Robertson and see his method of procedure, prior to the New Orleans meeting. On my return home I undertook to work out an operative technic, and to start a propaganda, based on observations made in the eastern states, that no tonsil was a good tonsil, and therefore should be removed forthwith.

Since that time we have watched the game progress, participating in it, to be sure, and have seen it claimed, in many articles on "Tonsils," that all diseases, between "fallen arches" and alopecia areata, including deformities of the nasal septum, high arched palates, as well as deformities of the teeth and jaws, are attributed to the tonsils, whether diseased or not.

Even the laity, with and without medical advice, frequently have insisted on the entire removal of the tonsils for almost every conceivable infirmity, and frequently for self made diagnoses.

It is not surprising that mistakes in diagnosis have been made by the laity, when we note that rheumatisms have proved on more careful medical study to have been classified as syphilis, neuritis, flatfoot, pellagra, arteriosclerosis, etc.

Shambaugh of Chicago, in his public utterances and published articles, does not decry the reckless removal of tonsils, and yet he states in one article that one must not omit the precaution of emphasizing the fact to the patient about to have his tonsils removed that the operation may have no influence on his disorder. His private utterances, however, suggest that a large percentage of tonsils should only be removed under exceptional circumstances.

During the past ten or twelve years I frequently have had children brought to my office after operation on the tonsils, by the mother, to be told, "My child is no better," and after hearing this many times and reading the unexpressed thought—"we wish you would repay the expenses we have been put to," I began to inquire of myself, if there was not somewhere an explanation of this surgical failure. My inquiry has taken me to many places and made many interviews with some of the internationally famous laryngologists, and my final conclusion is that the evidence points to an interrelation of the tonsil with the ductless gland system, and that the failure to recognize such relationship helps to explain, to my mind at least, the cause of failures such as have been encountered by myself.

I do not wish to decry the value of the removal of tonsils in properly selected cases, but I do wish to say that my belief is that there is a well founded physiologic interrelation between the tonsils and adenoids, and the ductless glands, and think that the signs of dysfunction of the latter, as evidenced in the child and frequently in the parent, should have proper attention and proper medication first before the child is rushed to the operating room.

We believe, too, that the apparent gland dysfunction in many cases is sufficiently predominant and offers a satisfactory explanation for the many reinfections, colds, etc., seen in large numbers of children, grouped under the so-called exudative diathesis by Czerny, Lyman and others.

It is largely to this type of children, who have a history of beginning life with an eczema, drippy, watery noses, asthma, who have difficulty in digesting milk, fats, carbohydrates, eggs; who may have big heads and big bellies, fat pads, are slow in their mental development, and who may have signs of spasmophilia, or on the other hand, may be precocious, sway-backed, flat footed, have winged scapulæ, thin, velvety or dry skin, deformities of the ears, high arched palate, sex organ deficiencies, and perhaps other signs of status lymphaticus, that our attention, therefore, is particularly directed.

We must include in the above the sign of slight hypothyroidism set forth in McGarrison's recent work, "The Thyroid"—i. e., "infantile constipation, unusual coldness of limbs; failure of fontanelles to close with normal period, slowness in learning to balance the head or sit up; delayed eruption of the teeth, and their malformation, early caries of the milk teeth, lack of vivacity, intelligence and slowness to learn to smile, somnolence, lordosis, scoliosis, slowness to walk, small and weak muscles, mouth breathing and snoring, adenoids and lymphatic enlargement, slowness to talk, rickets, tetany, neuritis, poor luster and growth of hair."

McGarrison in his book, quoting from Leonard Williams (*Encyclopedia of Medicine, Surgery*, London, 1912, page 265), summarizes his views as follows: "Adenoids and enlarged tonsils occur in children who have an inadequate supply of thyroid secretion. The hypertrophic condition in each case is apparently the result of an endeavor on the part of the organism to supply an internal secretion as nearly allied as possible to the one which is lacking. If the hypertrophy is not very pronounced, and if it has not been very long in existence, great enough and protracted enough, that is, to produce complications, such as disease in the tonsils themselves or in the ears, then the exhibition of thyroid extract will cause their regression."

Otto (Alienist and Neurologist, 1913, page 116, 120) reports some interesting experiments with the powdered dried tonsil of the calf, and the evidence from the experiments "suggest that they (the tonsils) yield to the blood a hormone which influences the contractility of involuntary muscles (uterus) and

the blood pressure, and possesses also a powerful diuretic action." (McGarrison.)

The frequent rather marked hypertrophy of other lymphoid structure in Waldeyer's ring, i. e., lingual tonsil and lymphoid masses behind the posterior faucial pillars—following the removal of the tonsils (complete enucleation) and the frequent filling in of the tonsillar spaces with lymphoid masses free from crypts—as mentioned by Bordley of Baltimore, as well as the persistent and oftentimes protracted vasomotor and vasotrophic changes seen in the pharynx and nose following operation, particularly in the exudative or anaphylactic type—above described—suggest strongly nature's effort to give to the economy a needed substance which surgery has removed. And the fact that the exhibition of minute doses of thyroid overcomes many of these symptoms lends support to this view.

The writings of Burt Shurley, S. P. Beebe and many other writers deal with the relationship of acute infection of the nose, nasopharynx, and particularly the tonsils, to hyperthyroidism with or without exophthalmus, though Shurley calls attention to certain pathology in the nose itself, present in hyper- and hypo-thyroidism.

While it is a well known fact that a case of simple goiter may be changed over night into an active hyperthyroid, through a sudden acute infection or a sudden shock, the fact of the patients having been probably a hypothyroid of years' standing, with parents perhaps of thyroid deficiency, is, I believe, frequently lost sight of, if considered at all, in this tonsil-ductless gland relationship.

That the recognition of the slight thyroid deficiency in early life and the treatment thereof might alter or prevent the advent of hyperthyroidism with exophthalmus, is evident.

Jules Glover (Paris) has called particular attention to the type of child presenting vasomotor disturbances of the nose, with watery discharge, and associated with recurrent swelling of the tonsils, unaccompanied by any signs of bacterial invasion and no increase in the bacteria normally found in the nose or on the tonsils. He also calls attention to a vasomotor condition of the nose following the removal of the adenoids, in subjects with subnormal pulse and temperature and signs of arrested development or general dystrophy. He finds the giving

of thyroid in combination with phosphoric acid and with occasionally the addition of an extract made from the tonsil, result in marked improvement of the vasomotor condition, as well as improvement in general conditions and reduction in the size of the faucial tonsils.

Harvey Cushing ("Pituitary Body," page 247) says: "In view of the unquestionably close relation of many states of dyspituitarism, particularly those of primary glandular insufficiency, to lymph hyperplasia (status thymolymphaticus), it is quite probable that there may be a tendency toward adenoid formation in the pharynx, irrespective of the presence of a pharyngeal rest."

Citelli, who has produced more readable articles on the relation of adenoids to the pharyngeal hypophysis and central hypophysis in dyspituitarism, than any living laryngologist, seems to have proved by his anatomic studies of the region of the pharyngeal pituitary and central pituitary an anatomic connection between the two—a craniopharyngeal canal—occurring not infrequently in subjects showing a large adenoid development. His histologic studies have convinced him of a hypersecretion of the pituitary in several of the cases studied.

As a result of these studies and clinical observation, he has called attention to a psychic syndrome occurring in childhood and adolescence "which may be complete or partial, as follows:

1. More or less marked deficiency of memory.
2. Somnolence or sometimes insomnia.
3. Intellectual defects.
4. Difficulty in fixing the attention.

He has found that some of these cases improve after removal of the adenoid but finds the addition of pituitary extract feeding gives better results.

Among case reports, he mentions a man of thirty years of age, complaining of "heaviness in the head, loss of memory, sleepiness." Examination showed adenoids, hypertrophy of lower turbinates, nasal stenosis. Improvement in thirty days on pituitary feeding without operation.

Another case, boy of fifteen, with adenoids, loss of memory, sleepiness, intellectual torpor, aprosexia, weakness in legs. Removal of adenoids, but after 40 days little improvement of

psychic symptoms. Then pituitary extract; soon great improvement.

Caliceti writing on "Hypophysary Feminism in Adenoid Subjects" seems to confirm the views of Citelli.

REMARKS.

Whether the presence of adenoids in these cases causes the hypophysary symptoms or results from infections of the posterior nares or adenoids primarily, does not seem a settled question. It would seem to me from a careful study of Cushing's cases and my own, that there are evidences that the state of status thymolympaticus was either acquired very early in life or was due to hereditary conditions, and thus the large size of the adenoids is simply an index of the dystrophy present.

Spolverini, writing about a series of nineteen cases of asthma seen in children, whose ages varied from six to ten years, says: "These children all showed more or less hypertrophy of the superficial or deep lymphatic glands, accompanied by tonsillar or pharyngeal hypertrophy, occasionally splenic or other tumefaction, pallor, facial eczema, low arterial pressure," etc. In other words, a status lymphaticus.

Haven Emerson, commenting on quite a large number of autopsies done on status lymphaticus adults, mentions the enlargement of lymphoid structures, the faucial, pharyngeal and lingual tonsils, and states definitely that these cases are especially prone to be overwhelmed by acute infections.

Ewing, "Military Aspect of Status Lymphaticus," says: "In infants, and before puberty, lymphatic hyperplasias, large thymus and signs of rickets are prominent, as well as hyperplasias of the lymphatic tissue in the tonsillar ring, intestine (Peyer's patches) and spleen."

Schlutz and Larson in "Anaphylaxis and Its Relation to Some Diathesis Common to Infancy and Childhood," have, as a result of their experimental work with guinea pigs, come to the final conclusion that "in at least one type of cases studied (inflammatory exudative diathesis, Czerny), definite anaphylaxis to foreign proteids exists, and probably the majority of the phenomena occurring in the condition are truly anaphylactic."

During my studies of the past three or four years I have tried to discover the underlying factors which help to explain the anaphylaxis occurring in hay fever and asthma, and it seems to me that such phenomena are more prone to occur in individuals of the status lymphaticus type.

This type of individual (exudative diathesis) should be properly classified among the "vagatonics," and he fits in well with the understood description of status lymphaticus. In addition to other physical signs, he does not stand the stress of life, he is not a good soldier, withstands infections poorly (as shown in the recent pandemics of influenza), and is easily overwhelmed by shock, whether from shell fire, food, animal hair or pollen proteins. His blood picture in a very large percentage of cases shows a neutrophile eosinophile increase.

Therefore, this type is entitled, in our opinion, to a careful hunt for the causes related to the anaphylaxis before surgery is resorted to. It goes without saying, however, that any focal infection, whether of the ear, nose, throat, teeth, gall bladder or appendix, should be removed, wherever found.

During the past year or so, I have seen some twenty-five children, from three to fifteen years of age, in addition to a fair number of adults, who have come with histories of hay fever, asthma and cold catching, nonbacterial in type. Most of these cases had their tonsils and adenoids removed prior to seeing me, and in none of these children had there been any improvement in their hay fever, asthma or "colds."

Few of these children were found sensitive to foods. Twenty-five per cent of the asthmatics have been found sensitive to animal hair protein, principally horse dander. Several to the orris root of face powder, a few to pollens, and some gave no reaction whatever.

The following cases may be of interest:

1. Child of four years, born at eight months, had a great deal of disturbances in early life from foods, was on a very carefully selected diet when I saw her.

Examination showed a serous catarrh of both ears, of two or three weeks' duration; a large adenoid and moderately sized tonsils. Opening both ear drums several times and treating the nose and throat did no good. The adenoids and tonsils were removed—the latter only on the insistence of the

pediatrist. Improvement for a few days and then the ears were as bad as ever. A more careful study showed the child anaphylactic to orange juice, which was in her dietary. On removing this the ears cleared up in twenty-four hours and the child has had no recurrence in one year.

2. An adult, about thirty-five years old, seen four years ago during my active service at the Southern Pacific Railway Hospital for recurrent attacks of colds, watery in type, and serous catarrh of both ears. I had Dr. George Willcutt open both ear drums repeatedly. He straightened a deflected septum and removed the tonsils without effect. The patient was then investigated for dietary disturbance and was finally found sensitive to potatoes. These were removed from his dietary and his ears cleared up. Two years later a similar attack following eating potatoes cleared up on removing the cause. This man had a thin, delicate skin, feminine in type, hair distribution also feminine in type, and shaved infrequently. He could be classified as a status lymphaticus type. His case is mentioned, as well as the preceding, to illustrate the need of careful study before operating. I am not the only one guilty of having followed an opposite course. I might say in extenuation, I was very early in the protein sensitization testing.

3. A boy of fourteen was put in the hospital for removal of his tonsils, principally because he had colds and because he was backward in school, and the operation had been advised by the family physician. I did not see him until he was under the anesthetic. Some cheesy material was found in his tonsils, otherwise nothing of moment about either the adenoids or tonsils. The boy looked like a little old man, his face was oldish, he had very dry skin, was thin, sex organs the size of a five-year-old. He was somewhat backward in school, but very fond of outdoor sports. He only had erupted four of his second teeth, and X-ray examination showed the congenital absence of six of the second teeth germs, and all the rest of the second teeth were unerupted and are scattered around in various directions in his jaws. What teeth he had are baby teeth except as noted.

He was not seen for several months following the operation, when the greatest changes were noted. The senile look had disappeared, the skin had become normal in texture and color,

sex organs normal for age, except for feminine hair distribution. No change in teeth and no change in desire for study; twenty pounds gain in weight. Whole pituitary has been given with some apparent improvement, and some thyroid, but neither have been taken with any regularity, perhaps due to parental indifference or lack of belief in the necessity of treatment. Both parents show signs of ductless gland deficiencies.

The results in this case are rather striking and unusual, especially the stimulation of growth of sex organs. The latter is hard to explain on any other basis than either the removal of an infection in the adenoid or relief of pressure on the pharyngeal pituitary from the adenoid. The improvement in metabolism is probably based on the removal of an infection in the tonsil which had a further influence on a hereditary hypothyroid subject.

5. Boy, aged thirteen, rather tall for his age; unusual sex organ development. Blood picture, polys. 54 per cent; lymph. 33 per cent; large monon. 2 per cent; eosinoph. 11 per cent. He gives a history of asthma, first beginning at the age of nine months, apparently following pneumonia and pleurisy at this time. The asthma has only occurred at long intervals and curiously only when there was a cat in the house.

For three years prior to September, 1919, when Admiral Rodman's fleet arrived, there had been no asthma. The gift of a cat from one of the officers brought on violent asthma.

On one occasion, three years ago, he had a severe attack of hives, following playing with a cat. No asthmatic history in family. The history shows that teething, talking, walking and school progress were normal. No apparent nervousness and the boy is quite even tempered. He has lordosis, flat feet, prominent scapulae, long thorax, drop ears, high arch, palate, deflected septum and irregularities in teeth, slightly dry skin, unusual sex organ development. Tonsils and adenoids have not been removed. Eating rolled oats gives him hives, so his mother says, and eggs disagree. Skin tests for these are negative. He was tested with all foods, bacteria, some pollens and animal hair, and proved to be sensitive to cat hair, crab, veal and ray grass. He was given immunizing doses of cat hair protein, the cat was sent away, and as the boy was appar-

ently thin for his age and height, was put on small doses of thyroid extract.

The net result for eight month is: No asthma, infrequent colds, gain in weight of fifteen pounds. Tonsils and adenoids appear reduced in size and without surgery.

6. Boy, aged fourteen, 5 feet $3\frac{1}{2}$ inches in height, weight 106 pounds. Blood picture: hemoglobin, 90 per cent; polys. 42 per cent; lymph. 45 per cent, large monon. 3 per cent, eosin. 10 per cent. His mother's emphatic announcement to me was "all my boy's troubles have followed the removal of the tonsils!" The history briefly is: Was bald until one year old. Had frequent colds. Tonsils partly removed at the age of seven; after that bronchitis began to develop, and severe sneezing colds occurring with great frequency during the year. In January, 1919, he had influenza. Following this asthma developed. In April, 1919, the tonsils and adenoids were re-operated, and the lower turbinates partly resected to relieve the sneezing and asthma, without benefit.

His mother says he was slow in every way except in his school. His personality was somewhat of a supercilious make up, rather irritating in type.

Examination showed a deflection of the septum with hypersensitive tubercle of the septum, nothing else in the nose and throat. He had flat feet, lordosis, prominent scapulae, sex organs very much undeveloped for his age. He was put on anterior lobe pituitary extract, grs. 4, daily. A few days of this gave him some headache, insomnia and nausea. The dose was reduced to gr. $\frac{1}{2}$ daily, and in a short time increased to gr. 4. Locally two drops of 95 per cent alcohol were injected into the tubercle of the septum (both sides), which seemed to relieve the sneezing for a few weeks, but returned in about six weeks.

The pituitary extract has been continued to date (seven months), and the result is that the asthma seems to have stopped, the sneezing gone and the cold catching tendency vastly improved. He has had but two severe attacks of asthma during this period, one of which appears associated with eating a lot of indigestible food, the other with an attack of bronchitis. Sex organs have begun to develop in a very satisfactory way, disposition has improved. He is in the hands of

a gymnasium teacher, to be taught proper breathing and exercises to strengthen his abdominal and back muscles, and there is every hope of making a fairly normal young man.

CONCLUSIONS.

Physicochemistry has to do with the origin and evolution of life, and if the chemical actions, reactions and interactions in the human body are controlled by the various ductless glands, then any alteration of the chemical interactions of the body may bring about disturbances of the body growth and disturbance of metabolism.

Inasmuch as the thyroid appears to be the great regulator of metabolism and particularly of carbohydrates, and as disturbances of metabolism as well as disturbances of the autonomic nervous system are outstanding in the anaphylactic type of individual, we believe such evidence of pathologic physiology should influence the medical man of today to a more careful study of the patient before ordering surgery directed to the nose and throat, that may result in harm and do the patient no good.

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**These articles were translated for me by Mr. W. A. Brennan of the John Crerar Library, Chicago.

XXIII.

THE NORMAL AND PATHOLOGIC PNEUMATIZATION OF THE TEMPORAL BONE—
A REVIEW.*

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It may seem to you rather extraordinary that a whole evening should be devoted to a consideration of a single man's work on one subject. I feel, however, that the matter is of such vast importance, and is so intimately connected with the practical, everyday work of otologists, that the time will not be misspent.

The work which we are to review was published in 1918 and consists of two volumes—one a volume of text containing 296 pages; the other, a volume of illustrations and 111 microphotographs of serial specimens of mastoids on which the conclusions of Wittmaack are based. I have had fifty of them reproduced for stereopticon demonstrations. The work was commenced about twelve years ago when Wittmaack began to accumulate his anatomic material for the study of cholesteatoma.

In order to bring before your mind the far reaching revolutionary character of these conclusions, it will be necessary for me to recall to you that up to the time of the appearance of Wittmaack's work anatomists divided the pneumatic portion of the temporal bone into three normal types: (1) The pneumatic mastoid, (2) the mixed form, in which the pneumatic structure was more or less equally divided with the spongy structure of the bone, and (3) the compact mastoid, in which few or no pneumatic cells were present. This was considered normal, just as the color of the various types of irises is considered normal. Variation in the pneumatic structure was not in any way regarded as the result of disease.

*Read before the Chicago Laryngological and Otological Society, January 3, 1921.

It is true that Wittmaack drew upon the work of various investigators in support of his thesis. He accepts the mode of pneumatization as described by Wildermath and others of the Strasser school, in their studies of the pneumatization of the bones of birds; in the pathologic processes he draws upon the work of such men as Bezold, Siebenmann, Toubert, Moure, Canapele, Lombard, Kanasugi, Preysing, Görke, Reitschel and others.

He divides the normal pneumatization of the temporal bone into three stages. Under undisturbed conditions the mastoid process at the end of the first or beginning of the second year consists of spongiosa. From then until about the fifth year it is a mixed spongiosa pneumatic structure, and from then on we have a complete pneumatizing proceeding. In the first period we have the formation of the cavum, recessus and antrum. At birth these cavities are filled with a myxomatous tissue which is covered with cuboid epithelium. At first there is a mere slit existing between this gelatinous tissue and the tympanic membrane. Gradually the embryonal tissue is absorbed or disappears, and the epithelium following it lines the air containing cavities; first, the cavum, then the recessus and at last the antrum. Normally when this pneumatization is undisturbed the submucous tissue consists of a very thin layer over the bone, and the epithelium changes from the cuboid type, normal in the embryo, to the endotheliated epithelium of one or two cells in depth.

At the end of the first or beginning of the second year the second stage begins and consists in the entrance of myxomatous tissue in the marrow cavities of the underlying spongiosa. The cells of these cavities are absorbed and at a given time the epithelium from the antrum dips down, and as it dips down the myxomatous tissue is resorbed until it becomes the submucous layer with the epithelium covering it. Thus an air space is made. This process goes on continuously by the invasion of marrow spaces by the myxomatous tissue until consecutively the air cells are completed at the end of the fourth or beginning of the fifth year.

The third stage extends through life and is denominated by Wittmaack as the stage of interstitial pneumatization. This consists of the formation of small pneumatic spaces communi-

cating with the larger spaces which are formed in early childhood in the nodal points of the network which forms the cells of the preexisting pneumatic spaces.

His conclusions are: (1) The development of pneumatic systems in the temporal bone—that is, the tubal cells, the tympanic cells and the mastoid cells follows a more fixed mode of developmental process with far greater regularity than has heretofore been believed. (2) The normal structure of the pneumatic process is characterized by a far reaching pneumatization and not by a sclerosing process. The individual peculiarities in the formation of the pneumatic system in later life—that is, after the fifth year, is not manifested by the peculiarity of the mastoid as a whole, but only as an interference in the peripheral structure of the pneumatic system. It will be seen, therefore, that he recognizes but one type of normal mastoid and that is one in which complete pneumatizations occur. The presence of spongiosa is a sign of arrested development.

What is the cause of this arrested development? And here perhaps we have the corner stone of Wittmaack's deductions. In seeking for the cause of this disturbance of pneumatization he reasons that the cause must primarily be searched for in the middle ear mucosa, the osseous structures evidently playing a secondary part in the process of pneumatization. Even in the normal process it is quite evident that the bone is subordinate to the changes which are wrought in it by the sub-mucous myxomatous tissue. It has been known for a long time and written about by many authors that the middle ear of the newborn and sucklings is subject to a peculiar inflammatory process which has been denominated the otitis media of the newborn, otitis media concomitans, etc. It is latent in its character and course and is discovered most frequently at the postmortem table. According to Solowzow, over ninety per cent of all newborn children and infants are subject to this inflammatory process in the middle ear. Preysing, Görke, Rietschel and more lately Göffert have extensively investigated this form of otitis media. The frequency with which it is found in children or infants rendered it difficult for Wittmaack to secure a large number of undoubtedly normal temporal bones in the first year of life. Much more easily could

temporal bones with this inflammatory process of the mucous membrane be secured. He concludes that the process is not physiologic but is undoubtedly a pathologic condition, and this view is supported by the presence of pus in the cavities of the middle ear and the known anatomic changes in the mucosa. These anatomic changes have been especially studied by Görke and Rietschel, and they agree that there are two definite types, a plastic and an exudative form, and Wittmaack suggests as a result of his investigations that these may be divided into a latent insidious type and a more acute form with a relatively rapid course. To these forms Wittmaack adds the hyperplastic changes in the plastic otitis media and an atrophic form with an exudate. It is evident that in the majority of cases we have a mixed type of these pathologic changes. The pure type of the first group is, however, clinically without symptoms and is, therefore, unsuspected during life. How this can affect the pneumatization will appear later.

The cause of this latent, symptomless, insidious form of inflammation was ascribed first by Aschoff to the aspiration of amniotic liquor, vernix or meconium into the tube and then into the cavum. The entrance of this irritant may occur in fetal life (aspiration of amniotic liquor), or during the time of birth (aspiration of amniotic liquor, vernix and meconium). The pollution of the cavum with amniotic liquor is, according to Aschoff, the cause of the presence of leukocytes in the cavum of the newborn. According to this view, otitis media neonatorum is not an infectious process, but rather a reaction to a foreign body. It does, however, according to Hartmann and other authors, render the structures more disposed to bacterial invasion. This is in agreement with the frequency with which bacteria are found in the exudate of the middle ear of newborn children. However, the foreign body reaction with sterile exudate may effect changes in the mucosa which will interfere with or check pneumatization. In fact, Preysing in a great number of all ears which he examined in the newborn found an exudate which was sterile. Among the infected cases the pneumococcus was by far the most frequently found. The changes wrought by the inflammatory process in the mucosa are characterized by a more or less intensive infiltration of the superficial layers of the mucosa and

the epithelium with round cells, dilatation of the blood cells and production of an exudate containing more or less pus corpuscles. The epithelial strata is changed to an extent that the ciliated epithelium (forming the tube) is found in places far removed, in the recessus and even in the antrum, areas in which the ciliated epithelium is never found in normal conditions. On this point Wittmaack differs from Preysing and Görke. His conclusion, based on a study of a large amount of material, is that the extension of ciliated epithelium over the mucosa of the middle ear must be regarded as a pathologic process. He has proven by experiments on the lower animals—rabbits, cats, etc.—by his production of a purulent inflammation in the ear that he can produce a spreading of ciliated epithelium.

The normal epithelium of late fetal or early infantile life in the cavum is cuboidal in character, which changes under normal conditions to the epithelioid type. The persistence of the cuboidal epithelium and the presence of ciliated epithelium Wittmaack regards as a mark of pathologic changes. The persistence of the cuboidal and ciliated epithelium coincides with other evidences of pathologic conditions in specimens showing interference with pneumatization, to a degree that suggests that his views are correct. Moreover, these abnormal epithelial types are not present in normal pneumatization.

Allowing for a relatively broad individual latitude in normal regression of the submucous tissues, there comes a time in the third to the fourth month where a normal type may be differentiated from an abnormal type. There can be no doubt that in the presence of the inflammatory process under consideration the superficial layers of the mucosa and the deep subepithelial myxomatous tissue shows no tendency to regression but, on the contrary, displays a tendency to thicken. Wittmaack differs from Preysing in this regard and criticises one of his illustrations which Preysing displays as a normal mucosa as being evidently an abnormal condition dependent upon an inflammatory process. Wittmaack believes that a normally developed mucosa cannot be differentiated into various layers, and when this is possible it is due to disease.

We have, then, the persistence, more or less complete, of the embryonal subepithelial myxomatous tissue, but undoubt-

edly a proliferation of the same. We have then an exquisitely hyperplastic mucosa rich in blood vessels. The superficial layer under the epithelium shows marked infiltration with round cells. Also there is a typical formation of lymph follicles. This thickening of the subepithelial tissue is especially to be found in the niches of the cavum and recessus. Another change which is characteristic of this condition is the formation of granulation nodules.

The point is made by Wittmaack that this inflammatory process causes the total or partial arrest of the recession or disappearance of the myxomatous embryonal tissue. This does not occur in a regular manner over the entire surface, but in a very irregular manner depending largely upon the inflammatory intensity at a given point. It can be readily understood how bridges of membrane may thus be formed by an incomplete resorption or abnormal strands of tissue, especially in the recessus epitympanicus and about the foot of the stapes—anywhere where there are sharp corners and depressions.

Granting that the inflammatory process causes persistence of the thick subepithelial portion of the mucosa represented largely by a hyperplastic type derived from the former myxomatous tissue, and remembering the manner in which the epithelium follows the myxomatous tissue into the marrow spaces of the bone, it can be readily understood how the process of pneumatization is arrested. It seems that the subepithelial tissue is deprived of its power of invading the marrow spaces, and where this does occur in a limited manner the epithelium has no power of penetrating, but remains as a level layer on the thickened submucous tissue.

He concludes, first, divergences from the normal structure of the mastoid depend without exception upon typical processes in consequence of changes in the character of the mucosa in the first and second years of life.

Second, the changes in the character of the mucosa may be grouped under the hyperplastic and fibrous types.

Third, the hyperplastic type develops from a latent insidious plastic inflammatory process in the mucosa.

Fourth, the fibrous type depends on an acute exudative inflammatory process.

Fifth, whether disturbance of the pneumatization is partial or complete depends upon the intensity of the changes in the mucosa.

Sixth, every type of disturbance of pneumatization gives a typical structure picture of the mastoid—

I. Complete arrest of pneumatization.

- a. By hyperplastic.
- b. By fibrous mucosa.

II. Partial arrest of pneumatization.

- a. In the hyperplastic inflammation (severe, intermediate and light grade).
- b. By fibrous mucosa (prolonged pneumatization).

Seventh, the concurrence of hyperplastic with fibrous changes in the mucosa occur with relative frequency and lead to mixed forms of structure types, sometimes with one and sometimes with the other component predominating.

What relationship does pathologic pneumatization bear to changes in the tympanic membrane? As the tympanic membrane is the one visible portion of the otic structures, it is interesting and important to know whether the changes in this membrane bear any relationship to pathologic pneumatization. Wittmaack is unable to say at the present time just what relationship slight and moderate anomalies in the tympanic membrane bear to the pneumatization process. This is readily understood when we remember that changes occur rapidly in the tympanic membrane after death. He believes, however, that he is safe in saying that the manubrium in the otoscopic examination lies in a course that is nearer to the posterior external auditory canal than in normal cases and the circumference of the tympanic membrane appears more oval and is smaller than normal in cases of disturbance of pneumatization. In other words, the infantile type of the tympanic membrane persists. Changes in the tympanic membranes themselves may or may not have a relationship to the character of the mucosa within the cavum. He points out, however, that slight diffuse and regular cloudiness of the tympanic membrane with a diminution in the luster is an indication of disturbance of pneumatization, together with the other changes in the mucosa which accompanies these disturbances. This cloudiness is due to increase in the cuticle layer of the

tympanic membrane and the decreased luster is due to a greater desquamation of the superficial layers. The cuticle layer of an entirely normal adult consists of a single layer of perfectly flat epithelium and this gives a bright luster. In hyperplastic changes of the mucosa we often find the deep cuticle layers composed of cuboid cells. The subepithelial layers show a thicker and richer vascularity. The superficial layers of epithelium are raised in lamella, which give them a rougher surface. This gives the cloudiness and lack of luster of the tympanic membrane on otoscopy. This is a normal condition in the first period of development and reaches frequently into the second period. In this way it is explained why in sucklings and small children we seldom find a tympanic membrane with the luster of the adult tympanic membrane. We very frequently find by otoscopy atrophy of the tympanic membrane in connection with the fibrous changes in the mucous membrane with complete or marked arrest of pneumatization. This is due to the arrest of the membrana substantia propria.

Abnormalities in the tympanic membrane are associated with arrested pneumatization indicated by spotting of the tympanic membrane by areas of thickening associated with areas of atrophy, the areas of thickening appearing as whitened islands, while the areas of atrophy give a darker tone to their translucence and the color of the membrane within the tympanic cavity.

Calcareous deposits in the tympanic membrane are not associated with changes in pneumatization. Peripheral cloudiness of the tympanic membrane is frequently associated with changes in the mucosa accompanying pathologic pneumatization.

What is the relation of pathologic pneumatization to the accessory mucous membrane bands and folds? It is known that in the recessus epitympanicus is found a number of ligaments and duplicatures of the mucosa. Wittmaack attempts to answer the question. What is the absolutely normal anatomic content of the epitympanic space? If we confine ourselves to the temporal bone with a completely undisturbed development we can say that in the recessus we find, besides the two folds, the ligamentum malei externum sive laterale, the ligamentum malei superior and the ligamentum malei anti-

cum. Occasionally one or the other of these ligaments is lacking. Especially is the ligamentum maii superior inconstant. It is absent with relative frequency in high tegmens and well developed pneumatic cells.

When the bones are examined at a time when the myxomatous tissue is not yet completely absorbed, the anlage of these ligaments can be discerned within the tissue in the form of fibrillary strands and presents a resistance to the ingrowing epithelium similar to that displayed by the ossicles.

The development of the inconstant so-called accessory folds frequently occurs from the incomplete absorption of the subepithelial tissue. In this way small bridges of tissue or sheets of tissue originate, reaching from one wall to the other of the epitympanic space. Zuckerkandl has previously described the development of accessory folds in a similar manner.

The arrest of pneumatization in the mastoid has a tendency to draw the sigmoid sinus forward, a very practical fact to remember in our operations on such cases. Especially noteworthy is the protocol in one of his cases (No. 38), in which complete arrest of pneumatization is pictured, and where the displacement forward of the sigmoid sinus is most marked.

In summing up the relationship which arrested pneumatization bears to other parts of the temporal bone, we find:

1. There undoubtedly exists a certain relationship between pathologic pneumatization and certain anomalies of the tympanic membrane, lusterlessness, cloudiness, atrophies, scars, etc.

2. Changes in the tympanic membrane cannot be regarded as always constant accompaniments of pathologic pneumatization.

3. In entirely normal pneumatized temporal bones we find only the constant ligaments in the epitympanic space. The development of accessory folds is a sign of pathologic pneumatization.

4. The displacement forward of the sigmoid sinus is found in pathologic pneumatization. The higher grades of displacement only with the worst form of disturbance of pneumatization.

5. The persistence and unusual breadth of the fissures is an accompaniment of pathologic pneumatization.

It is apparent that the work of Wittmaack explains many hitherto unexplained problems. It explains, for instance, the so-called chronic catarrhal otitis media which arises from apparently no cause and which has been explained on the hypothesis of an acute diathesis or a catarrhal inflammation. It explains the chronic tubotympanic inflammation, or at least places these conditions in an entirely new light.

The more important conclusions as regard the relation of arrested pneumatization to inflammatory disease of the ear may be summed up as follows:

I. Practically all severe forms of suppurative middle ear involvement develop in temporal bones with pathologic pneumatization insofar as this depends on continuous extension from the tube.

II. Chronic middle ear suppuration exists on the basis of complete arrested pneumatization, or the severest forms of disturbance of pneumatization, with markedly hyperplastic mucosa and develops in the child:

A. Chronic suppuration of the mucosa on the ground of the acute exacerbations of the suckling.

B. The chronic cholesteatoma suppuration, either (a) after acute necrosing otitis through ingrowth of the epithelium in consequence of large peripheral defects of the tympanic membrane, or (b) as an insidious process with intake of the pars tensa after sequestration of the antrum recessus from the cavotubal cavity in consequence of adhesions from Shrapnell's membrane, or an atrophy above, or adhesions above or below the posterior folds; (c) middle ear suppuration with epithelization or combination recessus cavum and cavum cholesteatoma suppuration and a combination of the process which leads to cholesteatoma formation.

III. The form which the chronic suppuration and its course pursues is preordained by the anatomic changes within the several cavities of the middle ear before the appearance of the clinical symptoms. Also, the secondary and end processes, such as the extent of perforation, epidermization, polyp formation, scarring, etc., depend upon a preformed anatomic substratum.

IV. The acute middle ear suppurations develop with predilection in medium and lighter grades of disturbance of

mucosa and corresponding character of the mucous membrane.

V The greater the hyperplasia, the thicker the epithelium, and the less the pneumatization, the greater is the tendency toward the occurrence of acute inflammatory processes and eventually a protracted course, and the less, on the contrary, is the tendency to frank mastoiditis and vice versa.

VI. The character of the secretion in an acute otitis media stands in direct relationship to the character of the mucosa. Thick, highly hyperplastic mucosa with ciliated epithelium is especially apt to produce a mucous or mucopurulent secretion. Slight hyperplasia with flat epithelium gives thick, purulent, tenacious secretion. Fibrous changes predispose to a thin fluid, serous or seropurulent secretion.

VII. Normally pneumatized temporal bones are most frequently infected in acute middle ear disease with resulting frank mastoiditis.

VIII. Middle ear inflammations of tubercular and luetic character exist on the anatomic substrata of the mucous membrane and its accompanying disturbance of pneumatization. Their course depends also on the changes in character of the mucosa as it occurs in the course of pneumatization.

The relation which pathologic pneumatization bears to endocranial complications is most interesting and important. In the pictures which I shall cause to be thrown on the screen you will find how frequently abnormal vascular communications persist between the abnormal mucosa, the meninges, the bulb of the jugular and the sigmoid sinus.

It would be impossible to give a complete account of the monumental work performed by Wittmaack. We must be content with this short and incomplete sketch.

Before closing I must, however, accentuate the very kernel of Wittmaack's deductions, namely, that nearly all inflammatory diseases of the middle ear, in their genesis, nature and course are dependent in certain anatomicodevelopmental changes in structure of the mucosa and osseous structures of the ear. Most of these alterations in structure are caused by a latent, insidious, inflammatory process which occurs in early life. In other words, if in late life an individual develops middle ear inflammation (catarrhal) with adhesions, fixation

of the stapes, etc., or the special suppurative type of inflammation is predestined when the occasional cause arrives by the changes which have occurred in the first years of that individual's infancy. On this fundamental principle he has erected a plausible, logical structure which must be proved or disproved by future investigations. True, there are discrepancies, and here and there we discover findings and conclusions which are susceptible of quite different interpretations, but on the other hand he throws light on many dark corners of otology and explains in a logical manner many points of pathogenesis which have heretofore been merely surrounded with meaningless words.

XXIV.

SARCOMA OF THE MASTOID.

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Malignant tumors of the middle ear and mastoid are very rare. This is especially true of sarcomata. Haug¹ found only fifteen cases of malignant growth of the middle ear and neighboring structures in all the literature written during the period of twenty years from 1870 to 1890, while Neuhart² could find only eight cases published in the United States up to 1918. Bezold³ observed one case of sarcoma in a series of 5,227 cases of ear diseases. In the records of the London Hospital,⁴ averaging 200,000 general patients per annum for a period of ten years, not a single one occurred. There was no case found in the ear clinic of Vienna⁵ among 10,157 patients.

Some of the latest textbooks on diseases of the ear, such as Kerrison,⁶ Barnhill,⁷ and Politzer,⁸ make no mention of sarcoma, while Dench,⁹ Urbantschitsch¹⁰ and Ballenger¹¹ refer to it briefly under the differential diagnosis of such conditions as retroauricular abscesses.

While carcinoma occurs more frequently after the age of forty, and sarcoma in the young, yet several cases of carcinoma have been reported in very young persons by Alexander,¹² Knapp¹³ and Nager.¹⁴ On the other hand, Milligan¹⁵ reported a case of angiosarcoma in a patient sixty-three years of age.

In 1898 Brose¹⁶ reported a case of sarcoma in a child three and a half years of age. Patient had slight pains in the ear for six months without otorrhea. Then a growth appeared in the canal with very offensive discharge. It was looked upon as an ordinary polypus and removed, but it recurred very quickly. This procedure was repeated several times until the mastoid became greatly enlarged. There was neither fever nor other ill health. An operation for simple mastoid was undertaken; neither pus nor cheesy matter was found, but

instead a soft reddish gray fleshy mass which upon compression yielded a pale grayish white juice. This mass was easily removed with a sharp curette. Bleeding was not severe. The tumor filled the mastoid cavity, antrum and ear canal and was completely cleaned out. It recurred very quickly, and signs of new growth were observed at the end of one week. The facial nerve soon became paralyzed. Dysphagia and aphonia developed. Patient died nine months after the first symptoms appeared. Microscopically the growth proved to be round and spindle cell sarcoma.

Christinneck¹⁷ reported two similar cases in 1894 and 1896. Another case reported by Haug¹⁸ in 1894 was that of a girl eighteen years of age with a chronic otorrhea of fifteen years' standing. The canal was filled with granulations which were removed with profuse bleeding. These granulations recurred in great masses, involved the surrounding tissues and, in six months' time, extended to the lower maxilla. The mass became ulcerated and discharged pus. Masses of tumor also made their appearance in the mouth and nose. The hearing became very bad. The facial nerve was not attacked. No sound could be heard upon catheterization of the eustachian tube on the affected side. The submaxillary glands were enlarged. An operation was performed nine months later, namely, a thorough exenteration of the tumor masses. There was no excessive bleeding. Recurrence, however, was rapid. Meningitis developed and the patient died two months after operation. On pathologic examination the growth was found to be a small round cell sarcoma.

Kipp¹⁹ in 1902 reported a case of a boy five years of age with a chronic otitis media and polypi of several months' duration. He was treated for three weeks, when the mastoid became involved and an operation was necessary. On opening the mastoid a large cavity above and in front of the tip was found, filled with granulations of large size and greenish color. The cavity extended far in towards the pharynx. The bone was found exceedingly soft. A radical mastoid was performed. From every part of the wound there was an unusually rapid and very abundant growth, which was again removed three months later. This procedure was repeated several times, when the patient began to complain of severe pain

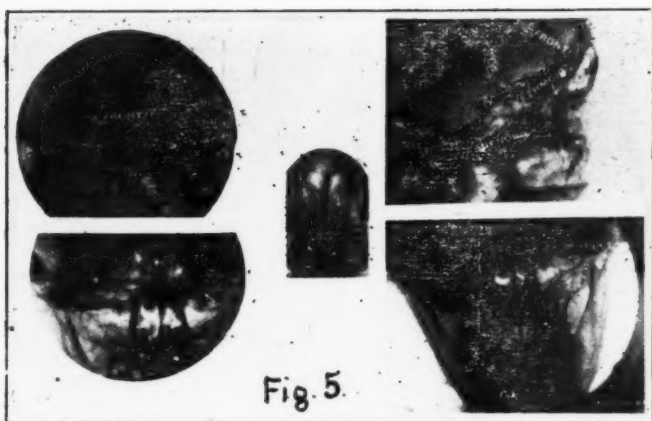
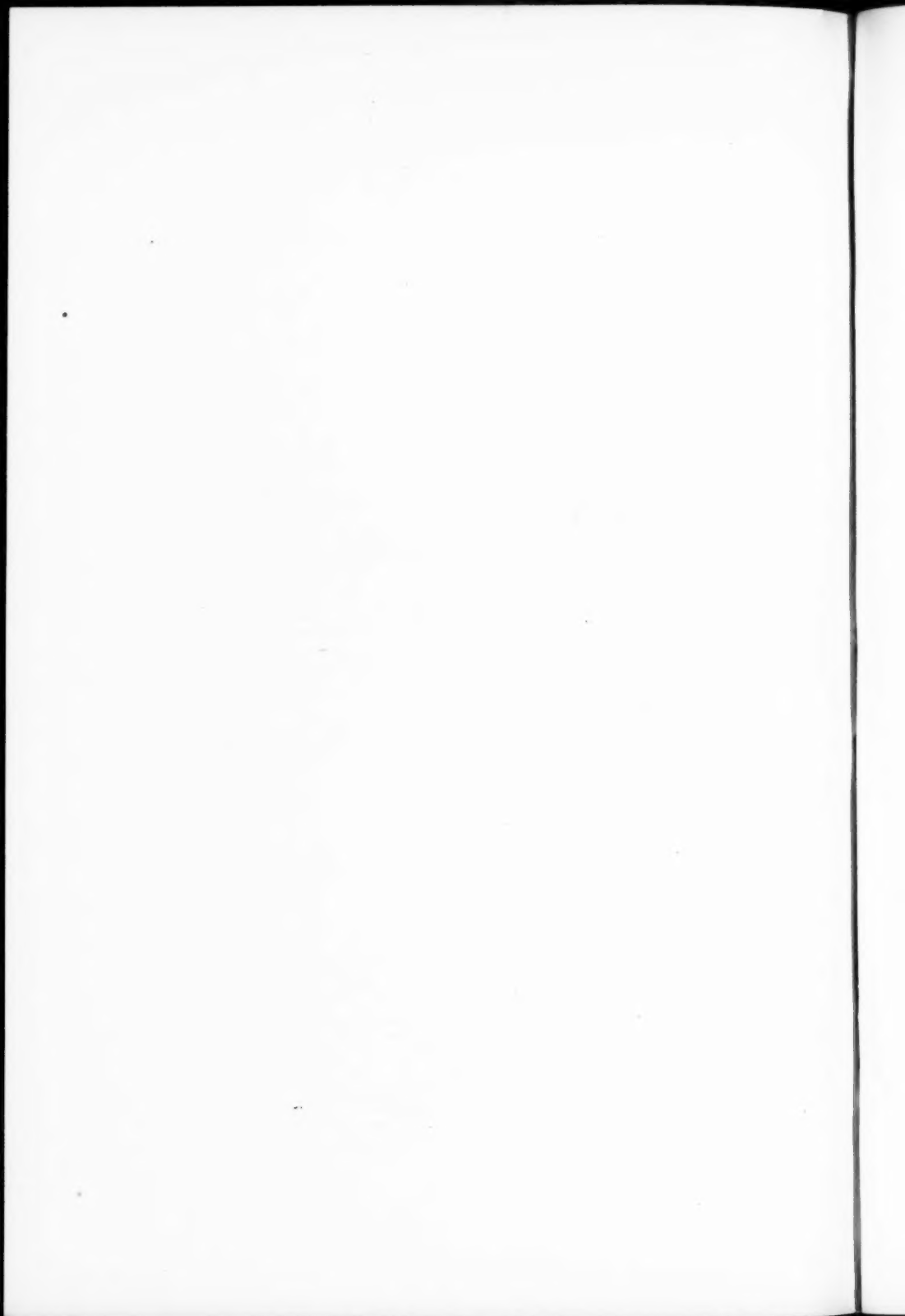


Fig. 5. Showing a complete set of sinus films and demonstrating exudate in the anterior ethmoid cells.



in the head. Paralysis of the facial nerve followed, optic neuritis also became evident and the growth assumed a very large size. The patient died six months after operation. The tumor, removed after death, weighed six pounds, eight ounces and measured 25 inches in circumference. Microscopically it proved to be a small round cell sarcoma.

In 1903 Dench²⁰ reported a case of endothelial sarcoma occurring in a child of eighteen months, with paralysis of the sixth nerve. X-ray therapy was applied, with temporary disappearance of the tumor. The patient, however, died ten weeks later from recurrence. This case was not operated upon.

One case of carcinoma has been reported by Treitel²¹ and Danziger,²² which followed closely upon an attack of influenza. A history of trauma from four weeks to nine months before onset of symptoms was noted in two cases reported by Milligan.²³ All the reported cases resulted in death within one year from the time the growth appeared except a case published by Tobey,²⁴ which was seen four years after operation with no signs of recurrence.

Chronic otitis media is not necessarily present, but on the contrary, sarcoma has usually been found in previously healthy ears. As a rule the beginning is unattended by any marked symptoms, but as soon as the canal is perforated there is a fetid discharge with the formation of polypi and granulations filling out the entire canal and extending into the mastoid, causing softening and destruction of the bone cells. These soon break down and fluctuation results. This has been mistaken for retroauricular abscess. The origin of the tumor can rarely be ascertained, as it grows very rapidly and infiltrates the neighboring tissues. According to Schwartz,²⁵ it may arise from the mucous membrane of the middle ear or from the antrum and then involve the entire mastoid, the parotid gland and eventually extends down the neck.

The superficial tissue ulcerates, while deeper down it involves the facial nerve, penetrating into the temporal fossa and resulting in death from six to eight months after onset. The granulations when removed cause more or less bleeding and there is rapid recurrence. Histologically round and spindle cell sarcoma is the type commonly found.

The case we wish to report occurred in a man 42 years of age, well built, a singer by profession, who sought medical aid November 5, 1918, on account of a slight reduction in hearing in the left ear. The family history was negative. He is married and has four children. There was no history of tuberculosis or cancer in the family.

Past history: Patient had had a facial paralysis on the right side three years before, of which he still presents some evidence. He remembers no other serious illness during his entire life. Patient had been examined by one of us six months previously and found to be in perfect health except for a slight laryngitis, which cleared up very quickly under treatment. During the epidemic of Spanish influenza of 1918 he suffered a rather severe attack with no ear complications at the time, but upon recovery claims to have noticed a defect in hearing in the left ear which still persists. He has neither pain nor discharge from the ear. Neither has he lost weight. At this time, three months after his illness, he has recuperated perfectly.

Upon examination the right ear is found normal. The left ear: The auricle is of the same size as the right. Half way in the canal a perfectly round fibromalike mass is seen filling out a little over two-thirds of its lumen and is attached to the posterior wall by a rather broad pedicle. Through a small speculum the tympanic membrane can be seen to be intact.

Hearing test: With "A" tuning fork, Weber to the left, Rinné positive both sides, Schwabach lengthened five seconds on the left side; C², C⁴ tuning forks and Galton whistle heard perfectly on both sides; whisper heard at eighteen inches on left; watch heard only three inches on the left and eighteen inches on the right.

Looking upon the growth as a simple fibroma, it was removed with cold snare. Bleeding was so profuse that a suspicion of malignancy arose, and much to our surprise the microscopic section showed "spindle cell sarcoma." The growth recurred quickly and filled up the entire canal. The patient began to complain of slight pains in the ear and mastoid region, although there was very little swelling and tenderness. There was a fetid discharge of bloody and purulent matter.

The operation was delayed for two months on account of the indecision of the patient.

On January 2, 1919, two X-ray plates taken gave the following information: "There is an absence of bone destruction in the auditory canal, the upper mastoid cells present but hazy, the lower cells are absent, and in their stead there is a large area of lessened density." Diagnosis given by roentgenologist was as follows: "There has been destruction of mastoid cells from some cause, either mastoiditis or malignant tumor."

The operation was performed January 7, 1919, three months after onset. An incision was made as in simple mastoid operation; the periosteum was found normal; the cortex was very thin. The cells of the mastoid process and antrum were destroyed and replaced by masses of tumor and an exudate of a pale yellowish color filling out its lower half. The growth did not extend into the aditus, and therefore the middle ear was not explored. The dura over the posterior fossa was found exposed. The lateral sinus wall was so eroded that while cleaning off tumor masses from its surface there was profuse bleeding. Otherwise there was little bleeding during the operation. The posterior wall of the auditory canal was partly removed. The entire cavity was packed with gauze and dressed as usual.

The dressings were changed on the fourth day. There was no bleeding, but a fetid discharge was found. Patient was subsequently dressed daily and the odor disappeared quickly. Recovery was slow, the wound closing in three and one-half months. The auricle became much enlarged soon after the operation, swelling subsiding slowly and by the time the wound was healed the auricle had returned to normal size. The canal was still very much narrowed and a minimal discharge was present. This also disappeared three months later.

The patient was last seen in April, 1921, more than two years after operation. He has had no recurrence and is apparently in good health. Hearing is the same as when he was first examined. He has been carefully examined by competent internists and neurologists, and metastasis have not been discovered. There has been no facial paralysis on the side of the tumor.

This case is of especial interest for the following reasons:

First, it is the only case on record where the origin is definitely known to be somewhere in the mastoid cells. Second, it follows closely upon an attack of influenza. Third, this case has survived a period of more than two years and shows neither

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THE MINOR ROLE OF THE CONDUCTION APPARATUS IN SLOWLY PROGRESSIVE DEAFNESS.*

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The function and relative importance of the conduction apparatus, given a normal end organ and normal hearing, is well understood. The physics of sound production, transmission and perception in health obey definite laws that are accepted by all aurists in principle, if not in detail. The object of this paper is to ask your consideration to the relation of the conduction apparatus to certain pathologic conditions that have resulted in or are causing deafness.

Our present conception of the etiology of nonsuppurative deafness has been influenced by the gradual differentiation of the function of the perception and conduction apparatus. Among the many questions that could not logically be explained by attributing to the conduction apparatus the cause for the progressive loss of hearing through interference with the sound waves, was the difficulty in accounting for the upper part of the scale always being lost first. This was usually accompanied by tinnitus—that is, labyrinthine irritation. Again, in progressive deafness there was a tendency for the hearing test to become equal, until by the time the low limits had been raised to about 512C² the Rinné and low limits would not vary even a few seconds for the two sides. It was not conceivable that the pathology of the eustachian tube and middle ear could result in equal loss of function in so many cases. Third, when suppuration had resulted in the destruction of the membrana propria, with necrosis and sloughing of the malleus and incus, it was observed that in many cases the hearing was

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exceptionally good, especially if the process was of the fulminating type. At times even sound perception might be painfully acute, although the conduction apparatus was disorganized. This leaves only the stapes. Is this indispensable to normal hearing? If we have an immovable stapes with a normal end organ, even this condition, if it were possible, would not preclude fairly good hearing for the spoken voice. When the stapes become fixed in the oval window, as the result of fibrous bands formed during the course of a chronic nonsuppurative otitis media, the perception apparatus has been functionally impaired long before the stapes loses its mobility. When fixation of the stapes is accompanied by profound deafness there is also an associated perception deafness that is more important than the condition of the oval window. It is then outside the conduction apparatus that we must look for the real cause in progressive loss of hearing. In the experience of the writer, there is no such thing as a pure conduction deafness. In every case of deafness, in whatever category you may classify it, there is diminished tone perception from the beginning. It is this impairment of tone perception that is the important problem in any attempt to arrest or restore lost hearing. Lastly, it is common knowledge that nerve deafness frequently follows acute and chronic systemic poisons and that certain drugs in full dosage have a disastrous effect on the organ of Corti. These findings make it necessary to reconstruct our otologic concept to conform to the newer pathology, or, as so often happens, confirm our clinical findings but explain the etiology in accordance with our recent views. It is true that certain types of infection show inflammatory reaction that in one case is confined to the mucous membrane, in another to the fibrous tissue and in still others to the osseous elements as end results. These manifestations of involvement of the middle ear are of secondary importance, however, as compared to the question of damage, temporary or permanent, to the end organ. Let us take the nomenclature of the last international congress and try and interpret it along these lines. In the child obstructed with adenoids, or in the adult with tubotympanic catarrh, the deafness is not due so much to the closure of the eustachian tube and the interference with the conduction apparatus as such,

but rather that the closure of the tube is followed by absorption of air in the middle ear, indrawing of the membrana tympani, impaction of the stapes in the oval windows and labyrinthine disturbance. This is accompanied by tinnitus and a loss of tone perception in the upper part of the scale which is functional for a time, but is ultimately followed by nerve degeneration. To be sure, in a child with adenoids, the low tone limit may be raised temporarily. This becomes normal, however, as the eustachian tube opens, but the loss in the upper tone limit continues if the loss of hearing is progressive. When, therefore, in a case of chronic catarrhal otitis media the low limits are again raised, the upper limits have been markedly cut down. This would indicate that the progress of chronic deafness was not because of increasing obstruction in the middle ear, but because of further impairment of tone perception.

In those cases of (O. M. C. C.) chronic tubotympanic catarrh we find not only that the upper tone limits were lost first, but that where the course has extended over a number of years there may be also areas of tone deafness with the lower limits unchanged. These findings are accompanied by a ground glass appearance of the membrana tympani, loss of the light reflex and indrawing. Where the changes in the membrana tympani were characteristic there was no question as to diagnosis. There was a type of case, however, that did not show changes in the membrana tympani and where we were accustomed to find a clean nasopharynx. These cases were classified as catarrhal adhesive otitis media, or, if the deafness was pronounced, with changes in the bone conduction, they were called by some beginning otosclerosis. It was not uncommon to find typical changes on one side and a clear membrana tympani on the opposite side, and yet the hearing, after a number of years, might be almost identical. This type of case, whether atypical chronic catarrhal otitis media or not, begins with loss of the upper tone limits and tinnitus. There may or may not be areas of tone deafness. As the disease progresses the hearing gradually tends to become the same on both sides, the tinnitus becomes more high pitched, and there may or may not be vertigo. The progress of the disease is not, in the judgment of the writer, influenced very much by the

changes in the conduction apparatus. The primary step is a closure of the tube, causing intralabyrinthine changes in the perception apparatus, and a raising temporarily of the low limit. The process in the eustachian tube may then run its course and yet the deafness goes on, influenced by the acute exacerbations of a toxic focus, i. e., after the deafness is once established it is progressive, not because of increasing mechanical obstruction from adhesions, tissue thickening or bony deposits in the conduction apparatus, but because of loss of tone perception from damage to the end organ, from the reaction to a definite chronic infection. That the upper conversational limit is first impaired has been confirmed by the audiometer of Dr. Dean.

Silent areas occur so often in nonsuppurative otitis media that the hearing test may be misleading. If we happen to test our bone conduction with a fork corresponding to the silent area it would, of course, not be heard or be transmitted to the other side. Even an approximately correct conclusion in regard to hearing cannot be reached without using all the forks from 96a to 2048C¹, nor without several tests by the same observer in a given case. As before stated, the upper part of the scale is lost first, and, as we would expect, both air and bone conduction are lowered for certain forks unless there is a concurrent middle ear, for sound waves, produced by the striking of a given fork, are registered in the same part of the perception apparatus, whether passing through a media of air or bone. It follows, then, that with no obstruction in the middle ear any lowering of bone conduction must be accompanied by a lowering of air conduction for the same fork. On the other hand, any obstruction in the middle ear would raise the bone conduction and lower the air conduction for forks below 512C². The higher the fork required to register a lowering of bone conduction the better the prognosis (Miss C. G.). The hearing test alone with all the forks is the only guide in estimating the remaining function in any given case of deafness. This is only a help, for no hearing test and no aural examination now known can tell us whether nerve degeneration has actually commenced. The evidence increases that while we may have pure nerve deafness we never have pure conduction deafness; the fact that some nerve impair-

ment exists in every case of deafness was not recognized, as in the usual tests we rarely resorted to all the forks. The loss of the upper register, whose lower limit is roughly indicated by the whispered voice, is then *prima facie* evidence that the deafness is due to damage to the end organ.

Inspection of the *membrana tympani* gives us no information as to the function of hearing, neither does it enable us to form any conception as to whether we can hold out any hope for the future. The immobility of the *membrana tympani*, malleus or incus, areas of atrophy, or even the absence of the *membrana propria*, do not justify a gloomy prognosis nor give much information that is helpful to the patient. These are end results, and unless we have some definite pathology that explains the different steps that have led up to this condition and can determine whether the cause is still active, we are not in a position to do the patient any good.

Etiology.—From the experience of the writer, the primary infection, so far as the deafness is concerned, is usually in the lymphoid tissue. In children, primarily, in tonsil and adenoid infection. In adults, without regard to age limit, usually in the tonsils, especially the supratonsillar fossa, with secondary involvement of the surrounding lymphoid tissue, especially in the pharynx. These foci date back to the infectious diseases and are subject to repeated exacerbations. Even when there is obvious sinusitis or bony necrosis in the mandible, in the majority of cases there had been a preceding chronic infection in Waldeyer's ring, which apparently started in the tonsil. The lymphatic connection between the supratonsillar fossa and the middle ear is direct, and there is usually a history of sore throats as a child but none of late years.

Prognosis.—The writer is willing to admit that he does not know from the first examination whether an advanced case will improve or not. It all depends on the amount of damage to the perception apparatus. The *membrana tympani*, malleus and incus may be gone and the promontory bare, and yet if this was the result of a sudden explosion of a virulent infection the nerve function would be but little impaired. On the other hand, the *membrana tympani* may appear almost normal, with a progressive secondary nerve atrophy so far advanced that the case is beyond help. It is rarely the case that one ear

(usually the one last infected) does not improve. We have much to learn in the treatment of those cases where nerve degeneration has actually commenced. After the cause has been removed, whether we can, in these advanced cases, reclaim any lost function by auditory reeducation, electricity, the use of strychnin, etc., is still an open question. The removal of toxic foci thoroughly must always be an individual equation. The war experience has taught us that much can be done by perseverance in restoring lost function. In the judgment of the writer no department of otology offers so much encouragement or so large a field of usefulness as the treatment of slowly progressive deafness.

Treatment.—Treatment of the eustachian tubes, either by bougies or inflation through a septic field, is never justifiable as a routine and never does any good in chronic cases. It can readily be understood that anything causing a secondary pharyngitis would have a bad effect on the hearing. As a matter of fact, the writer has never seen marked improvement in hearing in chronic deafness from any treatment that did not include freeing the supratonsillar fossa of infected tissue, whether this be in patients of ten or sixty-five years of age. Do not try to increase the mobility of the ossicles or pay any attention to the conduction apparatus except to free it of infection. Remember that toxic products are being constantly thrown into the circulation and that the perception apparatus suffers first from toxemia and then from nerve degeneration. In a certain number of cases the writer believes that after all sources of reinfection have been removed that much can be done by reeducation of the perception centers. That is, the central end organ does not seem to interpret the sound waves on account of functional disuse. On the other hand, it looks as though the highly specialized nerves, like the nerve of hearing, when degeneration has commenced, was uninfluenced by treatment. Experience has shown that very many cases given up as hopeless on account of nerve degeneration, were only functionally crippled. These cases will improve and stay improved with no other treatment than removal of the cause of the deafness. Moreover, these cases are not unusual, for it is the exception if one ear or the other does not gain if the low tone limit is still unchanged.

B.—O. M. C. C. S. S.: Eight years; school; Dec. 27, 1919. P. H.: T. and A. operation at Massachusetts General Hospital three months ago. Measles two months ago and since then she has been deaf with ringing in both ears. Examination: Ears—A. D., membrana tympani indrawn; dull; no thickening. A. S., membrana tympani indrawn; light reflex present but not clear. Pharynx: Epipharynx blocked by a large adenoid. Sinuses: Transillumination clear except over ethmoids. Diagnosis: Infective O. M. C. C.

R	W. V.	L
2/25		2/25
14/6	R 256C	16/6
—	W	—
64	L. L.	64

Treatment: Adenoid removed under gas. Feb. 24, 1920. Has ha da cold for two weeks.

R	W. V.	L
25/25		25/25
20/9	R 256C	15/7
	W > +	
40/13	512C ²	45/18
62/22	1024C ³	40/20
22/7	2048C ⁴	18/10
32	L. L.	32

(Hearing tests made by A. M. A.)

Result.—This case improved in hearing distance twenty-three feet without Politzerization or any direct treatment of the ears. The noises still continue.

Terminal stage in a case of slowly progressive loss of hearing extending over twenty years:

Mrs. R.—Fifty-two years; married. P. H.: Always well. No history of acute infections. Under constant treatment directed especially to the tubes by a competent aurist. No history of vertigo or tinnitus. A. U.: Ground glass appearance. L. R. gone. No areas of atrophy or thickening. No stapes fixation. Examination: Transillumination negative; no pus in nares; M. M. normal; septum straight; breathing free; no infection. Pharynx: Lateral pharyngitis marked, but whole pharynx shows a low grade pharyngitis. Tonsils: Cryptic tonsillar disease and mucopus in both. Pharyngeal secretions

changed and patient gets up every morning to clear her throat and sometimes during the night.

P. S.—The chronic focal infection in the tonsil, low-grade pharyngitis and infection of the lymphoid tissue in the mouth of the tube followed by deafness would seem obvious.

R	W. V.	L
Shout		Shout
7/15	R 512C ²	5/15
—	W>+	—
256	Galton	256
1024C ³	L. L.	
faint in A. D.		
2048C ⁴ not heard in A. D.		
2048C ⁴ faint in A. S.		

Fulminating case with great damage to middle ears. Marked improvement in hearing (without inflation), because the perception apparatus was not injured sufficiently to be followed by nerve degeneration.

Miss C. G., 28 years; B. Sweden; single; salesgirl. Ref., Dr. N. P. H.: Measles four years; aural discharge from both ears until 15 years old; then T. & A. operation and ears were dry until six months ago. Has colds every winter with swellings under jaws and soreness back of ears. No general illness since the measles but does not feel strong.

Examination: A. S.—O. M. S. Ch.; A. D.—Eff. O. M. S. Ears examined by Dr. C. T. P.

Considerable tonsil tissue in supratonsillar fossae containing mucopus. Transillumination negative. Band passing from left eustachian tube to posterior pharyngeal wall. Low grade pharyngitis.

R	W. V.	L
Shout		1 1/2/25
27/45	R 512C ²	28/46
	W	
256	L. L.	256
N	U. L.	N

A. S.: Directly ahead promontory is covered with granulations of watery pink color. The membrana tympani is entirely absent in the posterior half. Posteriorly can be seen niche of round window. Anteriorly and above remains of malleus. Shrapnel's membrane is covered with grayish membrane. Slight discharge. Diag.: O. M. S. Ch.

A. D.: Dry. Horseshoe shaped perforation involving entire portion of membrana tympani up to anterior and posterior ligament. Malleus intact with lower end tied down to promontory by band of adhesions. Underneath posterior superior border of perforation can be seen incudostapedial joint. Along posterior border of perforation can be seen niche of round window. Promontory is covered by mucous membrane. Tinnitus like steam. Diag.: Eff. O. M. S. Treatment: Tonsillectomy at Massachusetts Charitable Eye and Ear Infirmary, October 31, 1919.

Miss C. G.—

Jan. 8, 1920			Jan. 19, 1920		
R		L	R		L
8/25	W. V.	3/25	8/25	W. V.	4/25
7/17	R 256C	16/23	12/21	R 256C	11/21
20/32	512C ²	18/30	34/45	512C ²	20/40
20/33	1024C ³	21/31	32/20	1024C ³	45/33
14/10	2048C ⁴	12/7	16/9	2048C ⁴	19/9
128	L. L.	128	96	L. L.	96
Feb. 17, 1920			Feb. 24, 1920		
R		L	R		L
25/25	W. V.	8/25	25/25	W. V.	20/25
10/19	R 256C	13/19	9/15	R 256C	9/15
43/33	512C ²	35/29	22/17	512C ²	15/33
42/30	1024C ³	32/27		+<W	
10/16	2048C ⁴	7/10			
96	L. L.	64	256	L. L.	64
	+<W				

Result: In this case the conduction apparatus, if compared to a chain, has two or three links missing in its most vital part. The left ear still has a scanty discharge. The patient has had active ear involvement from childhood until twenty-eight years old, and yet the right ear gained twenty-five feet in four months and the left nineteen feet. No inflation at any time. After removal of the tonsils the accompanying infection in the pharynx and tube was treated as long as improvement continued. (Hearing tests made by A. M. A.)

B. O. M. C. C. (INFECTIVE).

Sept. 27, 1919. Miss R. A., 23 years; in college; home, California. P. H.: For six to eight years catarrhal colds. Last year throat infections; T. and A., two years ago; rheuma-

tism in arms and shoulders at fourteen years; measles at seven years. Four years ago A. D. commenced to be deaf; A. S., one year later. No tinnitus or vertigo. Thinks hearing is not so good as one year ago.

Examination: A. D.—Membrana tympani dull and indrawn; L. R. broken. A. S.—Membrana tympani indrawn; L. R. faint. No areas of atrophy or thickening. Palate pale.

R	W. V.	L
3/25		2/25
18/32	512C ²	22/37
32	L. L.	32

Treatment.—Infection cleared up. No inflation or any direct treatment of the ears.

Result.—From the first test one would hardly have expected the hearing to return to almost normal. The whispered voice improved from 3 feet to 25 feet.

R	W. V.	L
25/25		25/25
12/21	R 256C	10/13
27/16	512C ²	28/15
25/35	1024C ³	26/39
14/7	2048C ⁴	11/17
	W>+	
64 ?	L. L.	32

The tonsils were removed two years ago, but apparently she had no after-treatment for the epipharyngitis and tubes.

Miss A. M. C. Nov. 26, 1919. Single; 38 years. P. H.: Puffing tinnitus in right ear for seven years. Much worse for last two or three years. Slight vertigo. No history of aural discharge. Deafness has gradually developed. Has had an impacted molar removed. Tonsils and adenoid operation, also had tonsillar crypts burned with cautery recently. Duration of deafness uncertain.

Examination: A. D.—O. M. C. C.; M. T., dull, indrawn; L. R., broken. A. S.—O. M. C. C.; M. T., dull, indrawn; L. R. broken. X-ray of sinuses shows slight increase in density over the right antrum. The left ethmoid cells are hazy. Teeth negative.

Throat: Low grade pharyngitis. Tonsil remains, especially in upper part of fossa. Mucopus present.

Operation Dec. 30, 1919. Fenway Hospital. Tonsillectomy. Right antrum found negative.

Feb. 2, 1920			March 2, 1920		
R		L	R		L
1 1/2/25	W. V.	4/25	1/25	W. V.	25/25
0/7	R 256C	0/7	7/8	R 256C	8/7
—	W	—		W>+	
13/33	512C ²	13/26	14/22	512C ²	17/31
13/37	1024C ³	25/35	26/15	1024C ³	31/39
18/9	2048C ⁴	14/10	5/8	2048C ⁴	7/7
512	L. L.	128	256	L. L.	96

(Hearing tests made by A. M. A.)

Result.—In the right ear the lower limit was reduced from 512 to 256. The left ear gained 21 feet for the whispered voice and the low limit was reduced from 128 to 96.

N. H. B., 42 years; mill superintendent, Maine. Jan. 22, 1920. P. H.: Weight, 210 pounds. Nose broken when a child and deflected to the right. Deformity includes the bony framework. Deviation of septum to right occludes that side completely. Any nasal irritation is now followed by lacrimation, anterior nasal discharge and redness of the nose, accompanied by sneezing. Sleeps with his head raised and cannot stand much cold air. Has been growing deaf for seven years. Cannot hear his watch in the right ear by air conduction. Does not consider that his right ear is of any use in conversation. Two sisters are deaf. No general illness.

Examination: A. D.—Membrana tympani dull and indrawn; L. R. broken and faint. A. S.—Membrana tympani indrawn; L. R. faint; no areas of thickening or atrophy. A. U.—Stapes movable.

R		L
Shout	W. V.	Shout
N	U. L.	N
0/10	R 256C	7/12
	W>+	
2/18	512C ²	4/16
27/15	1024C ³	22/14
15/5	2048C ⁴	9/5
512	L. L.	256

Treatment.—Jan. 31, 1920. Operation at Brooks Hospital: (1) Submucous resection of septum. (2) Refracture of nasal bones and correction of external deformity. (3) Tonsillectomy.

Result.—In twenty-five days the hearing for the whispered voice in the right ear (which he considered of no use to him for conversation) has gained 25 feet and the low limit had changed from 512 to 256. The left ear had improved 3 feet. No inflation used. (Hearing tests made by A. M. A.)

February 24, 1920.

R	W. V.	L
25/25	R 256C	3/25
5/10	+ < W	5/8
12/16	512C ²	5/11
26/18	1024C ³	22/30
15/7	2048C ⁴	11/3
256	L. L.	256

CONCLUSIONS.

1. There is always a nerve element in every case of so-called conduction deafness of the progressive type.
2. The prognosis in regard to restoration of hearing is dependent upon the perception and not upon the conduction apparatus.
3. Toxic deafness and that due to beginning nerve degeneration cannot be differentiated by any aural examination.
4. Silent areas or islands of deafness are quite common in O. M. C. C.
5. The etiological factor is usually active in the lymphoid tissue as a chronic infection with acute exacerbations.
6. In some cases of long standing deafness it would seem necessary to reeducate the central perception centers by exercises, after all sources of infection have been eliminated.

XXVI.

ACUTE HEMORRHAGIC OTITIS MEDIA.*

By H. C. BALLENGER, M. D.,

CHICAGO.

In February and the latter part of January and early part of March, 1920, it was my privilege to pass through an epidemic of, for lack of a better name I might call an acute hemorrhagic otitis media. A better name might be an "acute streptococcic otitis media." This epidemic seemed to be confined to a few villages of the North Shore. Whether the proximity of the Great Lakes Naval Training Station or the camp at Fort Sheridan had anything to do with it or not I do not know. The epidemic apparently came from the North and appeared to reach its apex in Glencoe and Winnetka. It seemed to recede as it approached Chicago. At least I found very few other otologists who experienced this epidemic.

Altogether in a period of about three weeks, with a few cases preceding and following this period, I saw about fifty-six cases (a total of 72 ears) of various degrees of severity of this so-called hemorrhagic otitis media.

The onset was fairly sudden, with pain and temperature usually from 100 to 103 degrees. The ear drum became red and bulging quite early. The shortest time from a normal to a red bulging drum, which I witnessed, was two hours. In all these cases, with the exception of perhaps half a dozen, I was able to do an early paracentesis before rupture occurred. In 75 per cent of these cases, following the paracentesis, there was a sudden rise of temperature, usually in children, to 103°. In many cases the temperature rose to 104° and in a few to 105°. One of these cases I wish to report in some detail later. In very few of these cases did the paracentesis relieve the head pain.

I mention head pain because that more nearly described the discomfort than an earache. They would complain of a

*Read before the Chicago Laryngological and Otological Society February 7, 1921.

throbbing or aching head. They would not tolerate the twisting or undue motion of the head. The tenderness on pressure over the mastoid and vicinity was very marked in the more typical cases. Traction on the pinna also caused pain. As a rule this pain subsided in from three to seven days. A few cases had it for two or three weeks.

The most striking feature following the paracentesis was the profuse bleeding, which usually persisted for two to seven days, gradually changing to a pink serous discharge. In one case the bloody serum persisted for two weeks. As a rule this discharge appeared to be without trace of pus which could be discerned with the naked eye. However, a typical pus discharge would eventually occur. In most of these cases the bloody serum could be seen pumping through the incision synchronous with the heart beat. The canal could be cleaned out and would fill almost immediately. In the more marked cases pads of cotton would have to be kept over the ear to take up this excessive discharge, and in some cases it was necessary to change this pad every half hour.

The examination of the canal and ear drum did not reveal a typical sinking down of the posterior superior canal wall in any case of this series. Only one patient showed a swelling behind the ear and that for one night only. This case was interesting and I wish to report it in some detail.

E. C., girl, age 7 years, first complained of pain in her left ear January 26, 1920. I saw the child about two hours after the onset and found a red bulging ear drum on which I did a paracentesis without anesthesia. The ear bled very profusely. The following morning the mother called and said that the child still had a high temperature and had pain in the other ear. Saw child again and the first ear was still bleeding quite profusely. Examination of the opposite ear showed a red bulging ear drum similar to the first. Paracentesis was done on this ear without anesthesia. It also bled very profusely as had the first. The child complained of her head hurting very much. Both ears seemed to be tender over the mastoid region on pressure. The following morning I saw the child and both ears were still bleeding, although a somewhat lighter color than the previous day. The mother stated quite a hemorrhage had occurred during the night from the

left ear. So much so that one or two towels were soaked. The head pain still persisted and her temperature was still high, 103.5°. An attempt was made by the nurse to irrigate the ears with a warm saturated solution of boric acid, but so much discomfort was created and it seemed so futile, as five minutes after having it done the ears were discharging bloody serum as profusely as before, that I directed the nurse to do nothing but keep the cotton changed as soon as saturated.

The high temperature persisted and on the fourth day consultation was had with a pediatrician (Dr. Helmholtz) and with Dr. G. W. Boot. It was decided that no meningitis existed and that there was no involvement of the lateral sinus, but that there was a mastoid involvement on both sides.

The urinalysis taken the day before revealed albumin and pus. The leukocyte count was 13,000. A blood culture was taken by Dr. Helmholtz and he reported a streptococcus with a suggestion of a capsule.

On the fifth day, about 10 p. m., the mother reported a swelling behind the left ear, and as she was unable to get me she called Drs. Blatchford and Boot. They decided to operate immediately and took her to the hospital that night. Upon her arrival at the hospital she showed some improvement and the operation was postponed until the following morning. At that time I saw her and the swelling had disappeared and the temperature was down to normal. The child was feeling much better. It was then decided not to operate at the present time, due primarily to the presence of pus in the urine and the absence of any of the usual indications for the operation. For two weeks following this flareup there was a temperature varying from 99 to 100 degrees, and with a continuation of the bloody pus. The urine continued to show pus and albumin, and the blood count showed a leukocytosis varying from twelve to seventeen thousand. There was an occasional flare-up of temperature to 102°, but an absence of all signs of edema of the canal wall. No further swelling occurred behind the mastoid. The mother would not consent to an operation at this time, and on March 7, about six weeks following the onset, consultation was had with Dr. Gordon Wilson, and it was decided at this time that the simple mastoid operation was indicated due to the persistent otorrhea. Ten days later, with

Dr. Wilson assisting, I did the simple mastoid operation on the left ear. Recovery was rapid and uneventful. The operated ear was dry in two weeks' time. The right ear continued to discharge for three weeks following, when it dried up. Both ears have remained dry until the present date and the hearing in both ears is normal. The urine cleared up following the advent of the dry ears.

Another interesting case was Mrs. P., age 35, who called me about 2:30 in the morning, January 29, 1920, complaining of a very bad earache. She was just recovering from influenza, and on examination I found a typical red bulging drum with tenderness over that side of the face. I did a paracentesis on the affected ear which bled profusely. The opposite ear appeared normal. The following morning I was called and the patient complained of severe pain in the opposite ear. This ear drum was red and bulging, on which I did a paracentesis. It also bled profusely. The bloody discharge still persisted from the first ear. Her temperature following the paracentesis rose to about 104°. The pain was not lessened by the paracentesis, and on the following five nights it was necessary to give her opiates to control her, despite the fact that in my opinion opiates are contraindicated in this condition. The bloody discharge persisted for about a week, when it gradually changed to the purulent form. During this time she was running a temperature of 99 to 103 degrees and suffered extreme pain. However, there was no local signs of a breaking down, though extreme tenderness was present. Three weeks after the onset one ear healed up and the other was reduced to a minimum of discharge. She had a sudden recurrence of pain and a second paracentesis was done to enlarge the then present small opening. The ear at this time did not bleed and in ten days the second ear was dry. There has been no recurrence to date and her hearing is normal.

I wish to describe briefly a third case, Baby M., age 5, on whom a double paracentesis was done, followed by excessive bleeding from both ears, which persisted as a bloody serum for several days following the opening. Pain and tenderness persisted in both ears; temperature of 100 to 102 degrees was present for two weeks following. However, no local sign of

a breaking down of the mastoid process was present. The most striking feature in this case was the advent on the third day of black urine. Microscopic examination revealed pus and blood cells. Albumin was also present. The hemorrhagic urine was diagnosed by Dr. Aldrich and Dr. Wall in consultation as coming from an acute hemorrhagic nephritis. The child appeared toxic and the advisability of an operation was considered. However, an operation was postponed, due primarily to the presence of the hemorrhagic nephritis. The urine gradually cleared up, and in eight weeks both ears were dry with normal hearing. Her tonsils and adenoids were subsequently removed.

In view of the above typical cases and in the ultimate outcome of the remaining cases, the question would arise as to the advisability of an early operation when the general and local symptoms are so marked. It is my opinion that surgical interference during the early stages is a mistake, due primarily, as I believe, to a nonclotting in the small vessels, with the resultant danger of the infection being transmitted to the meninges, the sinus, or directly into the blood stream. In fact, in many cases I believe that doing a paracentesis is sufficient to create an avenue of entrance into the blood stream, as the profound symptoms could be explained satisfactorily in no other way. However, this is largely a surmise on my part, and I hope in the discussion this point will be mentioned. The two cases that came to operation were both operated upon some weeks following the onset, after all symptoms had subsided, with the exception of the persistent otorrhea. Both cases made a very rapid recovery and were left with dry ears and normal hearing.

All of the cases in this group have dry ears at the present time and so far as I know they all have normal hearing.

A few cases of this type which were operated early of which I have indirect knowledge had many an alarming complication, two cases developing multiple abscesses.

CONCLUSIONS.

I believe an early and free paracentesis is indicated, despite the subsequent rise in temperature and the hemorrhage, as all of my cases recovered with dry ears and normal hearing.

A minimum amount of interference during the bloody serous stage, whether swabbing or subsequent enlargement of the ear drum should be done.

The time of election for operation should be after the ear has quieted down, and it is done for a persistent otorrhea.

25 E. WASHINGTON ST.

XXVII.

BACTERIAL FLORA AND WEIGHTS OF A SERIES OF EXCISED TONSILS.

BY E. J. LENT, M. D., AND M. W. LYON, JR., M. D.,

SOUTH BEND, IND.

During the eleven months from August, 1919, to June, 1920, about half of all the tonsils removed at the clinic were weighed in pairs and a culture on blood agar was made from one of the crypts of one tonsil of a pair. In all 218 pairs of tonsils were weighed; 214 were cultured. The individuals from whom the tonsils were removed represent patients of the private practice in the city of South Bend and vicinity. The organs were removed for the usual causes, such as recurrent attacks of tonsillitis, sore throat, removal of foci of infections, hypertrophy, etc. The series includes persons of all ages, from early childhood to early old age, both sexes, and individuals of the various social conditions found in a prosperous industrial center.

In the last three years several important papers on the occurrence of hemolytic streptococci in the crypts of excised tonsils have been published. Nichols and Bryan¹ in 1918 reported hemolytic streptococci as found in 75 per cent of tonsils cultured; Blanton, Burhans and Hunter,² in 1919 reported 80 per cent; Pilot and Davis,³ 1919, 97 per cent; Tongs,⁴ 1919, 83 per cent; Maclay,⁵ 1918; Cummings,⁶ Spruit and Atem, 1919, 82 per cent, reported the presence of hemolytic streptococci among other bacteria found in the crypts of a large number of tonsils, the percentage not being stated. The results of the present study show little not found by other workers and serve to confirm their observations. The average percentage (61 per cent) of hemolytic streptococci in this series is somewhat less than that represented by other authors, though in some months it was as great as that reported by Nichols and Bryan.¹

The technic of making the culture was as follows: Each pair of tonsils was brought to the laboratory in a clean tin box. The two tonsils were then weighed together. One tonsil of a pair was then selected and a sterile wire loop was pushed into the bottom of a conspicuous crypt, rotated once or twice inside of the crypt and then smeared on the surface of a blood agar plate. If the tonsil was covered with mucus it was washed off with sterile water or salt solution. If the surface of the tonsil was merely moist and the crypt mouth well disclosed the wire loop was pushed into the crypt without preliminary washing. The blood agar plates were ordinarily made by adding 1 cc. of whole human blood to 10 cc. of melted agar in tubes and pouring into sterile culture dishes. In some cases a weaker proportion of blood was used. Each plate was divided by wax pencil lines into eight sectors and a loop of material from a crypt spread over one of the sectors. Plates were incubated aerobically for 24 hours and the resultant growth observed. Subcultures were ordinarily not made, and the character of the organisms present was determined by their appearance on the blood agar plate and by staining them by Gram's method. This method seems to be satisfactory for the demonstration of hemolytic streptococci. For the satisfactory demonstration of pneumococci and streptococcus viridans the method is not entirely satisfactory for complete identification. Here the colonies which yielded Gram positive cocci arranged in pairs and short chains, and which caused no change in the blood agar were identified as pneumococci, while those appearing in pairs and short chains and producing a greenish discoloration about the colonies were identified by streptococcus viridans. The results of these cultures of 214 pairs of tonsils are found in table 1.

The most commonly found organism was streptococcus hemolyticus, occurring a total of 129 times, or 61 per cent. The next most common organism was nonhemolytic staphylococci, occurring 122 times, or 57 per cent. These were followed in order of frequency by Gram positive diplococci or short chained streptococci provisionally regarded as pneumococci, 55 times, or 26 per cent, and by streptococcus viridans, 28 times, or 14 per cent. Other organisms occurred in small

numbers and corresponding low percentages. Organisms apparently identical with influenza bacilli occurred only three times, or about $1\frac{1}{2}$ per cent. Fusiform bacilli and spiral organisms were found twice. In these two instances these organisms were so numerous on the surface of the agar that they must have grown there and not have been left when the smear was made. As the plates were incubated aerobically and other organisms were present at the same time, the resultant growth must have been one of symbiosis.

In table 2 is shown the incidence of hemolytic streptococci in this series of tonsils from month to month. The total number of tonsils examined during any one month appears in most cases to be entirely too small to make reliable figures, there never having been 50 cultures in any one month. The percentage of streptococcus hemolyticus present ranged from 26 in November to 75 in February. The next largest number occurred in August and May when 72 per cent of the tonsils cultured showed the presence of hemolytic streptococci. The percentage of hemolytic streptococci in January and February, the months when there were many cases of epidemic influenza in this vicinity, are 63 and 75 respectively, but being based on very small numbers of tonsils removed during these months these figures do not have much significance. During the actual period of the epidemic no tonsils were removed.

Seventy-five percent in February is essentially no different from 72 per cent in August and in May. The three times in which influenza-like bacilli were found occurred once in September, twice in April. Most other work done on the culturing of tonsils appears to have been limited to an examination during a comparatively short period of time, but Maclay⁵ noted considerable variation at different periods of the year. It would appear, superficially at least, that hemolytic streptococci in tonsils shows some variation from month to month, when one considers the low figures in November with the higher figures obtained in other months. With such small numbers of cultures to deal with, one must be cautious, however, in drawing conclusions.

The weights of the tonsils in pairs ranged from two to nineteen grams. The average weight of 218 pairs was 7.08

grams. The usual weight of the tonsils lay between five and seven grams, which includes 32 per cent of all the tonsils weighed; 75 per cent ranged from four to nine grams. The various weights and their frequency are shown in table 3. As many of the tonsils were removed because of an hypertrophied condition, the average weight of all the tonsils is somewhat higher than the usual weight, the average being brought up by a comparatively small number of heavy tonsils appearing at the end of the table. That the usual weights represent fairly well the weight of normal tonsils is shown by the uniformity of the curve of the frequency of the weights. If the figures in the table are plotted out in a graph a maximum is found at 16.4 per cent, with a fairly uniform slope on either side until the excessively heavy tonsils are reached. The bluntness of the apex is an indication that there is considerable latitude in the weight of the normal pair of tonsils. The current belief that the largest tonsils are found in children was substantiated in collecting these figures, but the heaviest pair in this series came from an adult. The very light ones also came from adults.

CONCLUSIONS.

During a period of eleven months 214 pairs of tonsils were cultured. The most common organism found was streptococcus hemolyticus, 61 per cent. The next most common organisms were nonhemolytic staphylococci, 57 per cent; pneumococci, 26 per cent, and streptococcus viridans, 14 per cent.

The percentage of hemolytic streptococcus appears to vary from month to month.

During the same period 218 tonsils were weighed in pairs. The average weight was found to be 7.08 grams. The usual weight ranged between five and seven grams.

Since writing the foregoing, a paper dealing with the pathologic histology of tonsils containing hemolytic streptococci by Kellert⁷ has come to our attention. He found streptococcus hemolyticus of frequent occurrence in tonsillar crypts. In our series a considerable number of tonsils at the beginning of the investigation were sectioned and examined microscopically. Like Kellert, we were unable to detect any characteristic pathologic change in those tonsils which yielded large numbers of hemolytic streptococci. The sectioning was aban-

done after having examined about 25 or 30 tonsils. Our findings were essentially the same as those of Kellert, although polymorphonuclear leucocytes were not so abundant and cartilage was not found. In the crypt of one tonsil was found a bit of vegetable material with a cell arrangement suggesting leaf structure.

NUMBER AND PER CENT* OF ORGANISMS CULTURED AEROBICALLY
FROM TONSIL CRYPTS.

Organisms	Relative Abundance		Common		Few		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Streptococcus hemolyticus.....	87	42	24	11	18	9	129	61
Streptococcus viridans.....	12	6	14	7	2	1	28	14
Pneumococci	13	6	24	11	18	8	55	26
Staphylococci nonhemolytic..	14	66	44	21	64	30	122	57
Staphylococci hemolytic.....	3	1.5	8	4	6	3	17	8
Gram positive, tetracoccus								
forms	0	0	0	0	2	1	2	1
Gram negative diplococci.....	4	2	9	4	5	2	18	8
Bacilli of Friedlander group..	2	1	2	1	1	0.5	5	2
Influenza-like bacilli	1	0.5	2	1	0	0	3	1.5
Other Gram negative bacilli..	2	1	5	2	3	1.5	10	5
Diphtheroid bacilli	0	0	3	1.5	2	1	5	2
Bacillus subtilis	0	0	0	0	1	0.5	1	0.5
Other Gram positive bacilli..	1	0.5	0	0	0	0	1	0.5
Organism of Vincent's angina	0	0	1	0.5	1	0.5	2	1

MONTHLY INCIDENCE OF HEMOLYTIC STREPTOCOCCI CULTURED
FROM TONSIL CRYPTS.

Month	Percent	Number Cultured
January	63	8
February	75	8
March	48	27
April	54	22
May	72	11
June	70	10
July	0	0
August	72	43
September	60	30
October	62	24
November	26	21
December	40	10

*Fractions of a per cent have been as a rule disregarded.

WEIGHTS OF 218 PAIRS OF TONSILS.

Weights	Number	Percent
2—2.9 grams	2	0.95%
3—3.9	16	7.35
4—4.9	25	11.40
5—5.9	36	16.40
6—6.9	35	16
7—7.9	24	11
8—8.9	24	11
9—9.9	23	10.05
10—10.9	14	6.40
11—11.9	8	3.65
12—12.9	0	0
13—13.9	3	1.75
14—14.9	1	0.45
15—15.9	2	0.95
16—16.9	3	1.75
17—17.9	1	0.45
18—18.9	0	0
19	1	0.45

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XXVIII.

EPIDEMIC MASTOIDITIS.

BY JAMES E. REEDER, M. D.,

SIoux CITY, IOWA.

Any man who professes to practice otology and was not in the service during the fall and winter of 1917 and 1918, in my mind missed a great opportunity to witness one of the events in the annals of otology.

I happened to be in charge of the operative service at Camp Cody when the epidemic of streptococcus, pneumonia and mastoiditis hit us like a bolt out of a clear sky at the time we least expected such an unheard of and unprecedented catastrophe. Most certainly it was unprecedented, as it has been shown by other writers that precedent was set both as when to interfere surgically in acute mastoiditis as well as the postoperative care.

Just why such an epidemic should occur, there are a number of etiologic factors to be considered, but as yet of all the theories which have been advanced, none are satisfactory in explaining the true cause. True, it seems environment played a very important role, as the men were taken from all walks of life and thrust into an intensive training which they had to endure, and were not allowed to rest for some slight indisposition, but had to be quite sick to be admitted to the base hospital, no doubt all of this resulted in a lower physical resistance for some time until they became acclimated or had become hardened physically to stand the military routine. It was during this readjustment period these men were good subjects for any acute infection which might arise, notably acute streptococcic sore throat.

The streptococcus in its different types was the most important infection we had to contend with. This particular organism was not only an important etiologic factor in all primary infections, but played an important role as secondary infections following the acute exanthemas, such as measles

and scarlet fever. It seems this organism may be dormant, as it were, only waiting for an opportunity to become active upon any lowered resistance of its host.

I am convinced of this, as a number of the ward attendants had repeated cultures from the nose and throat, and they all showed a predominant streptococcus growth as well as a slight leucocyte count. These cultures and blood counts were taken weekly, and as long as the blood count showed a good resistance they were kept on ward work, but if a slight indisposition was apparent with low resistance these men were placed on other duty for a few days. In this way we were always able to keep our help in the mastoid ward up to very good efficiency.

It is not surprising, when one considers the foregoing, that we virtually had an epidemic of mastoiditis or at least sporadic, as we frequently had a number of cases from one company and not any from another, but from different battalions.

It was during December, 1917, and January, February, March and April, 1918, that we had such a large series of cases of (operative) streptococcus mastoiditis. From my observations I am convinced the mastoid is more frequently involved through the blood stream than was thought probable in the past.

Symptomatology.—Cases where the otitis media symptoms seemed to predominate and, say, slight pain over the antrum and a high temperature with a timely paracentesis, although the great percentage of these cases had gone on to rupture before they were admitted to the hospital—as a rule, this class will undergo resolution without surgical interference of the mastoid.

There is another class of cases in which the otitis media and mastoiditis appears simultaneously. A paracentesis is done at once, but the case is one of those fulminating types, and it is necessary to do a mastoidectomy in four or five days to relieve the pain. While the patient is very septic and may show a leucopenia, you then wonder how it is possible so much destruction could be done in such a short time.

Another class of cases were those complicating systemic diseases, such as measles. These cases would become involved

and the patient not aware of it until necrosis had taken place. These no doubt were infected through the blood stream.

Blood counts, if these were above 12,000, we watched the mastoid very closely. Headache is a symptom that to my mind is more important than is given credit, relative to complications of acute mastoiditis. A constant headache always means to me a dural irritation or a beginning meningitis.

Where precedent was set in this epidemic of streptococcus mastoiditis was the assurance of knowing just when to interfere surgically. This was determined by the following points, which I wish to emphasize: First, as a case was admitted, a culture was taken of the discharge, or at the time of the paracentesis a culture was taken. If this proved to be either pneumococcus or streptococcus, and at the end of the third or fourth day pain and tenderness still persisted over the mastoid along with a leucocytosis, also an occasional leucopenia asserted itself, we immediately opened the mastoid. A leucocytosis meant to us only an increased resistance, for some of the worst cases had a normal count or a leucopenia. Second, if the X-ray showed a large pneumatic mastoid along with history of sudden onset and continuous severe pain, this always meant early operative procedure. There is just one factor that stands out in acute mastoiditis which has always been more or less of guesswork, and that is bone necrosis. It is this factor alone that determines when we shall operate. If this could always be determined I believe our mortality following acute suppurative mastoiditis would be lessened. I believe we are nearer to this goal than ever before.

We have those classical cases. In these we have no difficulty, but the classical symptoms do not always appear. It is then we should rely on the X-ray, for it has been shown that when bone necrosis has taken place, in the absence of the classical symptoms operative interference should be instituted at once.

The Operation.—The operation for the removal of the mastoid cells is very much standardized, and I feel it is not necessary to discuss it here. Except I wish to make this statement that in the presence of a streptococcus infection it is best not to use the blood clot, as we tried it in twenty cases, and all but

three broke down. Of course this delayed the resolution, and I feel you are endangering the patient possibly to severe complications.

After-care.—We discovered it was best to use dry dressings along with rest and good food. We were disappointed with dichloramin-T. It is possible we did not use the proper technic. In the end we decided it was best to use dry dressings and let them alone.

Complications.—The two uppermost questions in our mind in any acute mastoiditis is the diagnosis of bone necrosis and complications. Our complications consisted of sinus thrombosis, brain abscess, meningitis, arthritis, endocarditis and a general streptococcemia.

Sinus thrombosis is too well known to be taken up in detail, but there is one thing we proved, and that is that a sudden chill followed by a rise in temperature does not always mean sinus thrombosis, but we had so many complications arise that it was the opinion of all that the blood stream no doubt was infected prior to the development of the mastoid or through the lymphatics from the mastoid region and not through the lateral sinus.

Erysipelas was a frequent complication but never proved fatal. It prolonged the period of convalescence.

The one complication which was most dreaded was meningitis. The necropsies show this to be a more frequent complication of pneumonia than was at first suspected. In one case of mastoiditis complicated by meningitis it was shown at postmortem that temporosphenoidal and cerebellar abscesses were found. The heart showed multiple abscesses throughout, and cultures from the pleural cavity were positive for streptococcus.

CONCLUSIONS.

1. Why such an epidemic of mastoiditis should occur in our army camps, it is difficult to say that any one thing was the etiologic factor, but a number of factors are to be considered. The one important thing which stands out most were the complications associated with the acute contagious diseases, such as measles.

2. The mastoid may become involved through the blood stream or the nasopharynx route.

2. Bone necrosis is the most important thing to keep in mind. This can be determined by constant use of the X-ray along with clinical manifestations.

4. Those mastoids following the acute contagious diseases as complications, in all probability, get their start through the blood stream and give us the most trouble.

XXIX.

ETHMOID OPERATIONS (DURING THE LATENT
STAGE) FOLLOWED BY DEATH. REPORT
OF CASES.

By L. OSTROM, A. B., M. D., MAJOR M. R. C., U. S. A.

ROCK ISLAND, ILL.

The literature of ethmoid operations presents such a wide difference of opinion that a brief resumé will prove quite interesting. Some surgeons have been very fortunate, while others have had more than their proportion of trouble. Williams¹ in his textbook says: "The mortality is low; I have been fortunate in never having a death." Lenox Browne²⁷ says: "This measure (curettement of ethmoid cells) is rarely attended by any risk." Packard², at our A. M. A. meeting, 1907, remarked that, "Septic infections following turbinal operations are by no means as common as one would believe. When we consider the large blood vessels and lymphatic channels which lie immediately beneath the nasal mucosa and the proximity of the tissues to the brain and its meninges, we would hardly think that the cases of meningitis, cerebral abscess, or thrombosis of the sinuses are as rare as they would seem to be after a diligent search of the literature on the subject." In my limited way I have tried to cover the literature on this subject and come to full accord with Packard, because I find very few references to the subject and remarkably few cases reported. There are, however, numerous hints and warnings that there is danger, and that others have had trouble, so where there is smoke one is sure to find fire.

The tenor of opinion of the dangers attending the operation, at the same time considering it comparatively safe, is well stated by Lack:²¹ "I do not wish to exaggerate the advantages of this operation (curettment), but rather to emphasize its dangers and the necessity for caution in performing it. The following, so far as I am aware, is a full account of the ill results that have been reported.

At least three deaths have occurred. Of one I have obtained no details. One was due to polypus forceps having been pushed through the cribriform plate, and therefore was not directly due to this operation at all. The third was due to fracture of the cribriform plate from scraping with the ring knife. I have performed the operation myself during the past eight years upon more than 150 patients without any fatal results. Serious ill results, although undoubtedly serious, seem to me small compared with the severity of the disease for which the operation is performed. The fatal results, so far as is at present known, were due to avoidable causes, and prolonged experience proves that the operation, when properly and carefully performed, is both safe and efficient."

Ballenger²⁵ follows the same tone: "Meningitis following ethmoid operations is rare. The chief point to be mentioned concerning them is that the operation should not be performed if a latent chronic meningitis is already present, as it may cause an acute exacerbation and extension which may prove fatal. The chief subjective symptom of latent meningitis is a severe headache. When this is present the operation should be postponed until it has been proved that it is not due to meningitis."

Loeb¹² admirably advises careful judgment in selection of cases and method of technic. "Operations on the ethmoid cells have been followed by serious results, such as sinus thrombosis, meningitis and death. The possibilities of these untoward results can be lessened by refraining from post-operative packing, postponing operation, when possible, in the presence of an acute infectious process in the nose, and by avoiding any injury in the vicinity of the cribriform plate."

Perhaps Moure¹⁵ expresses the true state of affairs, especially in regard to the reporting of cases. "We should not forget that the number of cases of death from meningitis or subsequent sepsis following surgical interference in the ethmoids is quite considerable (not to mention other unfortunate cases never published), to not make the surgeon careful who ventures to enter this zone, most dangerous, perhaps, from a surgical point of view, for an inexperienced hand or unskillful surgeon."

In their reports some writers suggest that complications, unless induced by faulty technic, seldom prove fatal⁹ and that meningitis is seldom a result of sinus suppuration but of an operation to relieve the chronic condition.²⁹

That often too much is done is emphasized by Prof. Kuemmel¹⁰ of Heidelberg, after reviewing a fatality following removal of the ethmoid labyrinth, "unless there is some vital indication, too little is better than too much interference in chronic frontal or ethmoid sinusitis." Seymour Oppenheimer¹¹ agrees with this statement: "If free drainage is present and there are no signs of ill effects on the general health but an occasional headache, and if the patient can be kept under observation, the risks of radical operation more than counterbalance the advantages."

On the other hand, that master rhinologist Hajek¹⁴ takes the opposite view, that too little may be done. In his reports of two deaths he says: "The complications had their origin not in the operated area, but in some overlooked ethmoid cell, some other neglected accessory cavity, especially in some area of pus which had not drained away and which had given rise to an area of infection."

Injury to the cribriform plate or adjoining cranial bones is perhaps the most frequently mentioned cause, yet very few cases are found reported. Thompson¹³ says: "The chief danger is from injury to the cribriform plate, as any damage in this area, occurring in the septic conditions which generally call for operation, is generally followed by fatal meningitis."

Douglass²⁰ in his book writes: "If the brain plate has been wounded or septic material has been conveyed to the dura mater, the patient may slowly develop a pachymeningitis. Sometimes this disease will develop after an operation without the infection or exciting cause having come from the nose. It happens that cases of ethmoiditis often develop a low grade of pachymeningitis and are suffering from it at the same time when they present themselves for operation for the ethmoiditis. Sometimes the operating surgeon in opening the cells of such patients excites an irritation of the dura and a spread of the meningitis, although the instrument has not been outside the proper field of operation."

A number of fatal reports are found where no injury of the cranial bones has taken place. Virulent streptococcus infection with fatal meningitis without injury to the cribriform plate after ethmoid operation is reported by Hajek.¹⁴ A case of purulent meningitis with death is reported by Knutson.¹⁷ Autopsy confirmed the diagnosis and showed that dura nearest the affected bone had not been injured.

Phillips²³ says: "It is contended by some observers that intracranial complications may be induced by the shock and irritation of the operation alone. In a limited proportion of cases of purulent ethmoiditis there is a preexisting latent meningitis or a circumscribed brain abscess, either of which may be excited to renewed activity by the manipulations incident to the operation, especially when carelessly or unskillfully performed." Fatal termination after simple removal of polypi is reported by Voltolini,³ 2 cases; Broeckaert,⁴ 1 case; Rethi,⁵ 1 case; H. Knapp,⁷ after removal of polypi and orbital tumor; Quinlan,⁸ after cautery of middle turbinate. Welty¹⁰ reports two cases following so-called intranasal operations (not his cases but came to his knowledge). Onodi²⁸ reports 11 cases of cerebral abscess occurring as complication to ethmoid operation. Sluder²⁴ mentions having 8 cases of meningitis but does not state operative measures.

Fatalities following other intranasal operations, submucous resection, etc., in the presence of latent empyema occur and have been reported.¹⁶ Perhaps a good many more occur than we have any idea of.

Compared to the radical operations the literature makes one think that these conservative operations are more frequently fatal than are all other intranasal operations put together. When we realize that the radical frontal, ethmoid, antrum or sphenoid operations are seldom performed by the general surgeon or embryo specialist, and that almost every graduate of medicine at some time removes polypi or some parts of the turbinates, and the dangers of sepsis are practically the same, one is apt to conclude that the ratio of ill results should be reversed. Gerber¹⁸ alone gives us the report of 46 cases following the radical Killian operation, more than I can find all together after other reported intranasal operations.

It has been my misfortune to have had three fatal terminations following simple curettement of the ethmoid cells. In each of these cases I am sure that no injury was done to the cribriform plate or adjoining cranial bones, nor was any septic matter conveyed directly to the dura mater. The operations were carefully executed with the idea only of obtaining free drainage, not of removing every vestige of diseased tissue, laying myself open to criticism of perhaps doing too little rather than too much. The patients were all apparently in good condition for the operation. No packing was used, careful asepsis and antisepsis carried out, and I know of nothing that could have been done to avoid the complications if I could have the opportunity to do them all over again.

Case 1.—Mr. B. M., age 37, Mazon, Ill., Dec. 26, 1906. Severely jolted and stunned in a railroad accident four to six weeks before I saw him. Back has been painful since that time. Has had difficulty in breathing through the left nostril for several years, especially in damp weather. Discharge of pus when he has a cold. Very little headache. Looks sick, very pale, but says he feels O K, except for pain in the back. No temperature. Heart and urine normal. Complaints of vague stomach trouble which he thinks comes from his nasal condition. Transillumination shows all sinuses clear. No pus seen in nose, but a small amount of thin serous secretion, such as is seen after sneezing spells, covered the entire mucosa. A large polyp arising by a small pedicle from the middle meatus almost filled the nose. This was removed with a snare, and arrangement was made to do a simple ethmoid operation the next day.

Dec. 27. Removed cystic and polypoid middle turbinate, curetted ethmoid cells, which were soft and easily broken down, leaving a clean field. Vomited during the operation. The operated area was afterwards swabbed with tr. iodine. No packing was used. Practically no bleeding followed the operation, but a profuse serous discharge, lasting almost two hours, made it appear as if there was an escape of cerebrospinal fluid. This stopped spontaneously and did not recur.

Dec. 28. Feels fine, no bleeding or serous discharge. Said he felt well enough to go to work.

Dec. 30. Found delirious in his boarding house and sent to

the hospital, Dr. Bradford having been called to see him. Temperature, 103. No headache, but severe pain and tenderness in back between the shoulders. Eyes, urine and reflexes normal or slightly exaggerated. Skin very yellow. Nose looks fine. A diagnosis of meningitis had been made.

Dec. 31. Temperature higher, 104 to 105. Eyes normal, no headache, but pressure on the cervical or dorsal vertebræ produced extreme pain. Reflexes of legs abolished. Control of rectum and bladder lost. Has good control of arms.

Jan. 1. Comatose. Died, Jan. 2. Spinal leptomeningitis. Body sent to his home at Mazon, Ill.

Jan. 6. Dr. Bradford informed me that a postmortem would be held to determine the cause of death and advised me to attend. We both went, and I, especially, met a very cool reception because the entire history seemed to point to the operation as the direct cause of death. On the removal of the skull cap, the brain, meninges, and the area about the ethmoids were found perfectly normal, without any evidence of infection or injury. Opening into the ethmoids showed a perfectly executed operation. I insisted that the spinal canal be opened, and when the laminæ and spinous processes were lifted off and the periosteum of the spinal canal incised, the pressure of the contained pus was so great that it squirted quite a ways up in the air. This was extended up to the second cervical and down to the second dorsal vertebra. (There was no pus below the second dorsal.) No culture was made nor was any microscopic examination made of this pus, because the postmortem was conducted for other purposes than merely scientific matters over which I had no control. Opening the dura showed the cord slightly compressed, dura thick, but no pus was found on or around the cord. The pus was confined exclusively to the epidural space. (Gray's Anatomy²⁰ gives a minute description of this space: "The spinal dura mater forms a loose sheath around the medulla spinalis and represents only the inner or meningeal layer of the cerebral dura mater; the outer or endosteal layer ceases at the foramen magnum, its place being taken by the periosteum lining the vertebral canal. The spinal dura mater is separated from the wall of the vertebral canal by a space, the epidural space,

which contains a quantity of loose areolar tissue and a plexus of veins. The situation of these veins between the dura mater and the periosteum of the vertebræ corresponds therefore to that of the cranial sinuses between the meningeal and endosteal layers of the cerebral dura mater. The spinal dura mater is attached to the circumference of the foramen magnum and to the second and third cervical vertebræ. It is also connected by fibrous slips to the posterior longitudinal ligaments of the vertebræ, especially near the lower end of the vertebral canal. The subdural cavity ends at the lower border of the second sacral vertebræ.") The fact that no pus was found below the second dorsal would have prevented us from obtaining any useful information if we had made a spinal puncture, a procedure which was not done.

The cause of death was a pachymeningitis of the spinal epidural space, caused perhaps by the trauma of the railroad accident, and an acute exacerbation induced by bacterial metastasis through the blood vessels following the operation. Needless to state that the hard feeling toward me changed very much after the postmortem was completed.

Case 2.—P. J., age 24 years, private secretary, has felt bad generally for a long time; nose stopped up, frequently sore throat, and pains in the arms and legs. Chronic ethmoiditis. Antra and frontal sinuses fairly clear on transillumination. May 11, 1914. Tonsillectomy; local anesthesia. Normal reaction and prompt recovery. Felt much better after the operation. May 29. Removed both middle turbinates and curetted ethmoid cells. Turbinates and ethmoids quite dense and firm. There was no pus present, but considerable thick, stringy mucous. Practically no bleeding followed the operation and the operated field seemed to be very satisfactory.

Dr. J. R. Brown, Tacoma, Wash., late president Washington State Medical Society, witnessed the operation. After completing the operation the entire operated field was thoroughly swabbed with tr. iodine, which caused Dr. Brown to remark that he had never seen more care given aseptically and antiseptically in any nasal operation. Patient felt fine for four days and was getting ready to return to Chicago.

June 5. Dr. Bennet, who referred him to me, met him wandering on the street, out of his head, with temperature 103 to 104, and sent him to the Moline City Hospital. When I saw him the next day I recognized a general streptococcus sepsis. Dr. Mock, physician to Sears-Roebuck, was sent down to help us. Autogenous vaccines (hemolytic streptococci from the patient's blood) were made and administered, but in spite of all our efforts he died June 11. Numerous large abscesses had by that time been formed in various parts of the body. Not until some time after his death was I informed that he had had a positive Wassermann. This I consider a general streptococcus septicemia following the operation in spite of all preventives, and not a meningitis. No postmortem was obtained.

Case 3.—Mrs. S. Mc. C., age 62, has had a discharge from nose for twenty years. Not much headache except when she has a cold. Health has been good most of the time. Transillumination showed antri and frontal sinuses fairly clear. Chronic ethmoiditis. In as good health at time of operation as she had been for years. Wassermann negative. Was anxious to get rid of the profuse discharge, and to improve nasal breathing. May 15, 1918. Operation. Removed both middle turbinates and curetted ethmoids, all of which were very soft and mushy and easily removed without using any force. The entire field was swabbed with tr. iodin. No packing was used. Was in very good condition following the operation and remained in St. Anthony's Hospital, Rock Island, Ill., for three days, but she felt so well on the third day that she left the hospital without my permission and went to her home, fifteen miles from the city. All next day she felt fine, but by evening went into a stupor and was comatose by midnight. Dr. Moore of Reynolds, Ill., was called, and he talked to me over the telephone about her condition, but I could give him no assistance. Her temperature rapidly rose to 103 and 104.5. At no time was there any headache, convulsions, or other physical signs except high temperature and coma. She died the following morning (five days after the operation) from acute pachymeningitis, in my mind excited by the operation, though there had at no time previously been any symptoms of latent meningeal disease.

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XXX.

ABSCESS OF THE FRONTAL LOBE SECONDARY
TO SINUSITIS.

By G. W. BOOT, M. D.,

CHICAGO.

F. P., age 41, Bohemian. Admitted to Cook County Hospital complaining of pus discharging from a sinus on the right side of the forehead, of fever and headache.

History: Patient is said to have had some sort of operation for nasal obstruction. The trouble in the forehead followed. (The physician who operated on him stated that this was not true; that he had not done any operation inside the man's nose but had only opened the subperiosteal abscess over the right side of the patient's forehead.) Patient was sick a week before entering the hospital.

Physical examination: Patient is a well developed man of 41. He has an opening on the forehead midway between the right eyebrow and the hair of the scalp above, from which pus is discharging freely. The surrounding area is deeply infiltrated. The scalp is edematous half way to the occiput and past the median line towards the left side. The right upper eyelid is edematous so that the eye can be only partly opened. The pupils are equal.

There is a large amount of pus in each naris, but particularly in the right. The nasal cavities contain crusts. Apparently all four turbinates have been removed either by operation or by disease.

Marked pyorrhea is present and the pharyngeal vessels are injected. The tonsils are small and submerged. There is no cervical glandular enlargement. Both maxillary sinuses light up well on transillumination. The frontal sinuses do not light up well.

Smears from the pus from the nose show a few chains of streptococci of from five to seven members.

Examination of thorax and abdomen is negative. The X-ray report states that there are no frontal sinuses.

Diagnosis: Suppurative right frontal sinusitis.

Twenty-four hours after the above examination was made patient became irrational and held his left forearm strongly flexed at the elbow and with the left upper extremity spastic. The head was turned strongly towards the right with conjugate deviation of the eyes to the right.

The abdominal, epigastric and cremasteric reflexes were absent. The pupillary reflex was present on both sides. Babinski was present on the right side but not on the left. The patellar and triceps reflexes were much exaggerated on the right side. Achilles jerk was present on the right side but not on the left. Ankle clonus and plantar reflexes were absent.

Patient does not remember that he was in the X-ray room yesterday. He points to the doctor, mistaking him for someone else. It is with difficulty that he can be made to fix his attention or do the simplest thing, as, for instance, look upwards, or to one side or protrude his tongue. On irritating patient by pulling his hair there is a coarse tremor set up in the left hand.

Lumbar puncture produces a clear fluid under increased pressure and containing 73 cells per cu. mm. Nonné + + +.

Blood count gave 14,200 whites. Blood pressure S. 130, D. 70. Edema of the right eyelid is greater than yesterday. Pupils are widely dilated but react to light. There is no rigidity and no hemianopsia. Ophthalmoscopic examination was not satisfactory on account of inability to keep the eyes still.

Operation: After the usual preparation the skin over the lower part of the forehead was infiltrated with $\frac{1}{2}$ per cent novocain and an incision made transversely from the midline through the right eyebrow to its outer extremity. The soft parts were retracted upwards and pus was seen oozing through the bone about two inches above the orbital margin. With a gouge the bone was removed over the usual location of the right frontal sinus, and finally a sinus about 2 cm. in diameter and $\frac{1}{2}$ cm. in depth was exposed and found full of pus. After the sinus was well cleaned out its posterior wall was removed and a large amount of pus found between the bone and the dura. This came from every direction for a distance of 5 cm. After enlarging the opening in the frontal bone and evac-

uating this pus the dura was found red and granulating. It was incised and pus found in the pia in every direction for at least 5 cm. An abscess cavity about 2 cm. in diameter was found in the inner part of the right frontal lobe, lying near the falx cerebri. It was evacuated and a rubber drain inserted. The skin incision was then extended across to the outer extremity of the left eyebrow and search made for the left frontal sinus by means of a gouge. The bone was excavated to a depth of about 2 cm., with no sign of a frontal sinus, so it was concluded that there was no left frontal sinus. The wound was closed with skin clips after inserting drains. The patient seemed a little improved after the operation, but soon relapsed and died in about 48 hours.

The peculiarities in the case were the suppurative rhinitis, the absence of turbinates, the abnormally thick skull, the absence of a left frontal sinus and the extensive involvement of the meninges and brain that must have been present at the time of the first examination without corresponding symptoms. At that time he walked into the examination room just as any other patient would walk and showed no sign of the serious intracranial trouble he was having. Twenty-four hours later he had spasm of the left upper extremity, with turning of the head to the right and conjugate deviation of the eyes to the right, and was comatose. Had he been able to speak English we might possibly have been able to note mental disturbance, but it is not likely.

The frontal lobe is notoriously a silent area. I have seen a sequestrum of the frontal bone 5 by 7 cm. separate as a result of a combination of syphilis and suppurative sinusitis, the dura bathed in foul smelling pus for weeks, with no symptoms referable to the brain.

On the other hand, I have seen suppurative frontal sinusitis on the right side cause a man to write his name upside down and backwards and to set up a sort of double personality so that the patient went to another town without realizing where he was and later "came to" and remembered that he lived in Chicago, and all these disturbances cease in a week after external operation on the sinus with drainage.

Definite symptoms of abscess of the frontal lobe are wanting. There may be the ordinary symptoms of brain abscess, such as

headache, choked disc and increased tension of the cerebro-spinal fluid, but, on the other hand, these may not be at all definite. The spinal fluid may be clear or contain but few cells, and changes in the fundus may be absent. Headache, while always present, is a symptom common to so many conditions that it has not much significance in abscess of the frontal lobe. For the present the diagnosis would seem to be best made by exploratory operation in any case of suppuration of the frontal sinus where headache is not promptly relieved by drainage and where lumbar puncture shows changes of an inflammatory type. If we wait until symptoms of involvement of the motor area present themselves the case is apt to have progressed too far for operative interference to be of much avail. In this type of case, when external operation on a frontal sinus is decided upon, exploration of the brain for abscess is justifiable. At least there is no harm apt to result from exposure of the dura. In any case of frontal sinus suppuration, where a subperiosteal abscess has resulted from the pus extending through the bone to its outer surface, remember that the inner wall of the sinus is thinner than the outer wall and fully as apt to be perforated by the pus. Hence in such a case explore inside the skull.

25 E. WASHINGTON ST.

XXXI.

REPORT OF CASE OF ORBITAL ABSCESS FROM ETHMOID SUPPURATION.

BY CLIFTON M. MILLER, M. D.,

RICHMOND, VA.

Orbital abscess has been usually considered an ophthalmologic condition, but from the etiology in the majority of non-traumatic cases it appears more properly to belong in the domain of rhinology. The great majority of cases of nontraumatic cellulitis of the orbit, whether they go on to resolution or suppuration, have their origin in infection of one of the nasal accessory sinuses.

The mode of infection from the sinuses varies. It may be through a dehiscence in or by perforation of the bony wall of the sinus. In these cases the abscess, as it were, ruptures into the orbit and the purulent cavity in the sinus and orbit is continuous through the opening. Skillern in his work on the accessory sinuses of the nose, says: "The continual apposition of the purulent secretion results in maceration of the epithelium, which gradually pervades the entire mucosa until it becomes, in certain areas, loose on the underlying bone. The purulent material, thus coming in direct contact with the bone, slowly infiltrates through the canaliculæ and Haversian canals (possibly with the aid of blood and lymph vessels) and eventually reaches the periosteum of the opposite side. From here on but little resistance is opposed to the spread of the infection. The infection may travel along the sheaths of the vessels and nerves." It has seemed to me that a thrombophlebitis of the ethmoid veins has been the cause of the majority of cases which have come under my observation.

Several cases of orbital abscess have been operated upon by me in the past ten years, and in all of them a careful examination of the wall of the sinuses has been made. In none of them could denudation or dehiscence be found, but in all the offending sinus was demonstrated by finding pus.

The ethmoid labyrinth seems to be the cause of orbital cellulitis more frequently than any other sinus. This is particularly true in children.

The offending sinus may be suspected by the direction of the exophthalmos, but the diagnosis must not be based upon this, a careful examination of the nose being indicated.

Case.—A. J. W. M., age eight years. First seen December 6, 1920. Parents living, in good health. Brothers and sisters healthy.

Boy well nourished, but rather small in stature. Quite bright and active physically.

Has had some of diseases of childhood. Physical examination negative except condition for which he was presented.

Status praesens: Father says that he has had a "bad cold" with profuse nasal discharge, more from right nostril, for the past week. This morning he awoke complaining of the right eye. Condition today has not been good. No appetite and does not want to play.

Examination reveals right nostril filled with profuse mucopurulent discharge. Nostril quickly fills up after being cleared out. Discharge seen coming from below middle turbinate. Gentle suction brings large amount. Slight swelling over upper inner angle of right orbit. Extreme tenderness on pressure over most prominent part of swelling. Motility of eye unimpaired.

With use of rest, hot fomentations over eye, gentle suction and spray containing adrenalin there was no change in the local appearance for three days, and the general condition of the boy seemed better. On the fourth day there was a change for the worse. Swelling more pronounced and painful, some exophthalmos, with cornea directed downward and outward. Marked loss of motility of eye, though there was still some voluntary movement outward and downward. X-ray examination at this time revealed cloudiness in right ethmoid and inner portion of right orbit. Operation was advised but not acceded to for about five days, at which time there was marked increase in the swelling and edema of conjunctiva. Exophthalmos very marked. No motility of eye, cornea turned downward and outward. Discharge from nose almost entirely absent. At no time was there any evidence of a con-

tinuity between the ethmoid and orbital abscesses. Pressure over orbital swelling caused no discharge into nose, nor did forcible inflation of nose produce bulging of the orbital swelling.

Under ether anesthesia incision was made into the abscess cavity through the upper lid and about 8 cc. of pus evacuated. Careful search of the inner walls of the orbit was made for denuded bone or an opening into the ethmoid cells but neither could be found. Wick drain inserted and wet dressing applied. Recovery prompt and uneventful with perfect vision and motility of eye. Ethmoid seems entirely free from disease at present.

This case seems to me to have resulted from a thrombophlebitis of one of the ethmoid veins.

STUART CIRCLE HOSPITAL.

XXXII.

AN ARGUMENT IN FAVOR OF PRELIGATION OF THE JUGULAR IN SINUS THROMBOSIS.

By T. H. ODENEAL, M. D

John ———, age 40, laborer, referred to me by a general physician, with swelling and tenderness over the zygomatic area of the right mastoid. Discharging ear for six weeks, during which time he had continued to work. Temperature slightly elevated, felt well with exception of slight pain in swollen area and headaches. No bulging of canal wall or undue sensitiveness on pressure of the mastoid proper (in my opinion, the character of the swelling often indicates sinus thrombosis, swelling high up without being extension from lower down being very suggestive).

On operation the sinus was found thrombosed, with the anterior wall necrosed and partly absent.

It is customary for me to ligate the jugular in thrombotic cases before removing the clot, but as the membranous wall of the sinus was partly absent in this case I removed some of the clot before deciding to ligate the jugular and then, having made my decision to ligate, packed the mastoid wound lightly and prepared for the ligation. The incision made, I began separating down to the vein, when the anesthetist informed me the patient had ceased to breathe. About three minutes before, the nurse had taken the pulse and found it normal. Artificial respiration and stimulants failed to revive the patient.

Death no doubt was due to an infarct originating from the sinus thrombus and lodging in a cerebral vessel, causing paralysis of the respiratory center. Had I ligated the jugular in this case before disturbing the clot I have no doubt the patient would be alive today.

I was very much interested in the discussion of the New York Otolological Society of March 25, 1919, relative to the merits of ligation of the jugular in sinus thrombosis, and the variety of opinions on the subject stimulated me to report this case, as we have here an actual and not a hypothetical

cause for preligation of the jugular in sinus thrombosis.

Whereas formerly the majority of ear surgeons believed in jugular ligation, I believe today they are in the minority, but this case has strengthened me in my former adherence to ligation in all thrombus cases.

In cases of seemingly localized phlebitis, where the sinus is covered with granulations and there is good pulsation, I never open the sinus, and have always had good success with such cases (ligation, of course, is also not done). This case is presented merely as a record, and I hope it will be of assistance as such.

ABSTRACTS FROM CURRENT LITERATURE.

I.—EAR.

Acute Meningitis of Otitic Origin as Observed in the Desgenette Military Hospital During the War.

Lannois and Sargnon.

Rev. de laryngol., d'otol., July 15, 1920.

From November, 1914, to December 31, 1918, 24,600 ear patients were seen. Of these, 5,500 were admitted to the hospital; 630 operations were practiced upon the ear, of which 34 were for otitic meningitis. The number of deaths in the 5,500 cases were 74. Of this number, 26 were due to otitic meningitis. Nothing peculiar was seen in the pathologic anatomy of the cases. Of the eight cases which recovered, in two no microbes could be discovered. The others belong to a variety of serous meningitis with polynuclear action more or less marked. In the fatal cases, on the other hand, the organisms were easy of determination. Ten times pure streptococcus associated with staphylococcus; one case with pneumococcus; meningitis due to streptococcus were decidedly the most grave.

From the standpoint of evolution, three forms can be distinguished: the fulminating, the acute and the subacute. The prognosis varies according to the form. The fulminating type are beyond help; of the acute form, 18 out of 27 had brain abscesses, six recovered; the subacute type furnished two recoveries.

The authors lay great weight upon operating at the earliest possible time. Repeatedly they have operated immediately, day or night, as soon as the lumbar puncture established the diagnosis. Beyond the thorough cleaning out of the mastoid, they practiced only repeated lumbar punctures, at first daily and later every second day until the severe symptoms moderated. In addition to this, they recommend the systematic employment twice daily of hot baths for thirty minutes at a time.

Harris.

Paroxysmal Bilateral Suppurative Otitis Media.

Levesque.

Rev. de laryngol., d'otol., April 30, 1920.

The author dwells on the important role which the sympathetic fibers of the trigeminal play in the anatomy and physiology of the nose, throat and ear. Lesions in the eye and in the ear caused by section of the trigeminal in the neighborhood of the Gasserian ganglion have been studied both in the laboratory and in certain cases of brain tumor. They are described under the name of neuroparalytic keratitis and neuroparalytic otitis. The latter is more capable of demonstration than the former. Such a case following tumor of the ganglion has been seen by Levesque. Closely

allied to this so-called false otitis is a form of otitis which, in his opinion, is due to an irritation of the sympathetic fibers of the trigeminal. Such a case he has recently seen. It was a young woman who from November, 1911, to the end of 1914 had more than forty attacks of acute suppurative middle ear disease on the right side and more than twenty on the left. The attacks lasted from four to five days and were followed by complete cicatrization of the drum. The onset of the attack is announced by sharp pain in the ear for six or eight hours, accompanied by somnolence hyperacousis and abundant salivation. The face is congested, the conjunctiva injected on the side involved, much lacrimation, profuse discharge from the nose with cough. Paracentesis has been repeatedly performed. Twenty-four hours after the beginning of the attack the drum membrane no longer bulged, gradually resumed its normal color, no perforation persisted, and there was no evidence of scarring. Simultaneously, all the mucopurulent discharge from the nose gradually ceased.

In the author's opinion, this is a case of sympathetic fiber irritation, the cause resting either in the accessory sinuses of the nose or in the teeth. In this particular case, removal of the nasal polyp had no effect upon the attacks. He adds that in another case he has noted the disappearance of the polyp by simple removal of a diseased tooth, and, in many cases, shrinking in the size of the polyp following attention to the teeth.

Harris.

What Is to Be Understood by Aberrant Mastoid Cells.

Mouret.

Rev. de laryngol., d'otol., etc., May 31, 1920.

In the year 1901 Prof. Moure gave the term of aberrant cells as the result of a case at that time under his observation, where a mastoid operation had been performed which was followed a month later by meningitis and death. The autopsy showed a purulent cavity lying on a horizontal plane which passed through the upper pole of the external orifice of the auditory canal and 1 cm. posterior on a vertical plane passing through the summit of the mastoid. A wall of compact bone 0.5 cm., eburnated and healthy, separated this cavity from the antrum.

Based on this finding of Moure, Mouret has made a careful study of the whole subject. In his opinion, Moure's case is one of otitis. A priori, the separation caused by the thick bone of compact tissue "can only be apparent," although the communication between such a cell and the antrum cannot be direct. In order to determine accurately such a separation, it is necessary in the course of an operation to go to the internal cortex. It is Mouret's custom in his mastoidectomies to make a deep groove in the bone posterior to the antrum and parallel to the line of the temporalis. In this way he repeatedly has found deep seated cells which were absolutely isolated from the mastoid. The explanation of the existence of the wall of bone lies in a fusing of the petrosal to the squamous portion of the temporal.

The author describes the embryology of the mastoid and concludes that in its development the bands connecting the petrosa and the squama gradually disappear, although the tendency of both

laminae is to grow together. Mouret has carried out extensive experiments with the injection of methylene blue and has demonstrated his contention that these deep seated mastoid cells are really not isolated but connected with the antrum. He makes the following conclusions:

a. That a wandering cell is a pneumatic cell of which the connection with the other pneumatic cavities of the temporal bone does not appear at first inspection and requires in consequence to be sought for. There does not exist in fact an isolated pneumatic cell separated from the entire cavity which communicates with the outer air. A pneumatic cell has need of air in order to live normally.

b. When one encounters an infected mastoid area separated from the large pneumatic cavity, there is a disposition to speak of it as an aberrant cellulitis. Otitis, however, secondary to a middle ear inflammation, is not rare. Very frequently it constitutes the only mastoid lesion which makes one think of the presence of a wandering mastoid.

c. The presence of cells removed from the antrum is one of the causes which favor strongly a large and deep mastoidectomy as compared with a simple antrotomy. Harris.

Local Anesthesia for Simple Mastoid Operations.

Koebbe, E. E.

J. Am. M. Ass., Chicago, 1921—LXXVI—1334.

For all of the cases, 1 per cent procain with from 1 to 2 drams of 1:1,000 epinephrin solution to the ounce has been used. The procain and epinephrin are boiled separately. An ordinary 2 cc. Luer syringe with a No. 23 gauge 1-inch needle has been used. The subcutaneous tissues are first infiltrated, beginning at a point directly posterior to the external auditory meatus in the line of incision and following the line of incision to its most upper and anterior point, and then downward anterior to the pinna as far as the level of the tragus. The next infiltration begins at the same point as the first, and extends downward to about 1 inch below the mastoid tip. At this point a slightly deeper injection is made; this effectively blocks the great auricular nerve. Directly below the mastoid tip a deeper injection is now made; this blocks the posterior auricular nerve. The branches of the small occipital nerve are now blocked about $1\frac{1}{2}$ inches posterior to and on a level with the external auditory meatus. The needle is now inserted from behind the ear into the posterior wall of the external auditory canal, nearly to the attachment of the tympanic membrane. This step is very important, as the patient will experience pain when the periosteum around the canal is elevated, and the pinna is pushed forward, if this injection is not made. Finally, the needle is thrust under the periosteum in four or five places so that the anesthetic completely infiltrates all the periosteum that is to be elevated. All this is done before the skin incision is made, and it is not necessary to use any more anesthetic after the operation has been begun.

It requires from 6 to 8 cc. of solution to complete the anesthesia. As soon as the last injection has been made, skin clamps

are used to hold the mastoid sheet and towels in position. It is not necessary to wait after the injection has been finished before the incision is made.

A general anesthetic is more or less difficult to administer to a patient undergoing a mastoid operation, on account of the position of the patient, small amount of space and danger of contaminating the field of operation. If the patient's tongue has a tendency to fall backward, or if there is an excess of mucus, the difficulties are still further increased. Then, too, the operator and his assistants usually inhale a considerable portion of the anesthetic. A large proportion of mastoid operations follow an attack of measles, which may also have been complicated with pneumonia and in which a general anesthetic would be given more or less reluctantly. In this series, thirty-five were mastoid cases that followed otitis media complicating measles, and five of the patients had or were recovering from bronchopneumonia at the time of operation. By employing local anesthesia we were able to operate earlier in a large percentage of the cases than would have been possible if it had been necessary to give a general anesthetic. In one case of frank lobar pneumonia, operation was performed on the third day of the pneumonia. The patient recovered uneventfully from the pneumonia and the mastoid wound was healed on the twelfth day.

This method is applicable to all patients except children too young to be reasoned with. In this series the ages range from 15 to 32. However, there is no reason why patients much younger than 15 should not be operated on by local anesthesia, provided they have not been terrorized.

Emil Mayer.

II.—NOSE.

Trephining of the Frontal Sinus.

Mouret.

Rev. de laryngol., d'otol., August 15, 1920.

In the last twenty-five years the author has performed all the various operations upon the frontal sinus. The Luc operation has given good results where the sinus is small. It does not allow, however, sufficient room for curetting the entire ethmoid or when the frontal sinus is very large. The Kuhnt gives good results, but the after-appearance is bad. The Killian gives good esthetic results, but as a result of the resection of the orbital roof and especially most of the internal wall, it allows the soft tissues of the orbit to prolapse into the nose and so often sets up a secondary narrowing of the nasofrontal duct.

The radical operation upon the frontal sinus should have these objects in view:

1. Opening the sinus.
2. Removal of all granulation tissue.
3. Curetting the neighboring cells which are diseased.
4. Obtaining the establishment of a permanent opening into the nose.

As the result of his long experience, the author has abandoned all the classical procedures. Of them all, he regards the Killian as the best, but to this he finds the following objections: The

prolapse of the soft parts, primary or secondary infection of the periorbital tissues, and stricture of the nasofrontal canal. So far as the first objection is concerned, he states that he has observed in all cases operated on by this method a certain drooping of the soft parts which tends to injure the esthetic result. He lays particular attention upon the primary or secondary infection of the periorbital tissues, and where this does not occur has noted edema of the upper eyelid following the operation, also a denuding and stripping of the orbital floor of the sinus. Even more serious are the inflammatory swellings of the soft tissues of the upper internal angle of the orbit, coming on several weeks, even several months after the operation. Occasionally, a small abscess will form here. His most serious objection, however, is the narrowing of the nasofrontal canal. In small sinuses, the cavity can be obliterated by the method of Killian but not where it is large. It is common to witness the gradual narrowing of a nasofrontal canal, which immediately following the operation was wide open.

As a result of these objections, Mouret favors the Ogston-Luc or the Taptas operation. The former, however, is intended only for small sinuses and possesses the objection that it does not enlarge the nasofrontal canal nor permit of a complete curetting of the ethmoid. The Taptas operation is favorable to sinuses of a larger size and permits of curetting the lateral masses of the ethmoid, as a result of the resection of the ascending process of the superior maxilla. He makes in the anterior wall of the sinus several openings which are separated from one another, permitting the introduction of the curette. This, Mouret believes, is more desirable than the method of Killian. When it is a case of a large sinus with marked development in the roof of the orbit, Mouret favors in addition to the double frontonasal and supraorbital openings a third opening in the external half of the orbital floor of the sinus. He takes great pains, however, not to disturb the inner part of this floor, and especially the orbital portion of the nasal fossa of the frontal which forms the external wall of communication of the sinus with the nose. Operating in this way, one avoids secondary narrowings of this part, upon which depends communication with the nose after operation.

Harris.

III.—PHARYNX AND MOUTH.

Examination of the Throat in Botulism—A Question of Differential Diagnosis.

Vernieuwe.

Rev. de laryngol., d'otol., June 15, 1920.

The author reports the case of a young woman who presented herself to him complaining of a nasal voice, where a paralysis of the soft palate was found. At the same time symptoms of the lack of accommodation showed themselves. A diagnosis of postdiphtheritic paralysis of the soft palate was made. Later, her brother developed the same symptoms. A paralysis of the soft palate was also diagnosed, as well as failure of accommodation. In addition, he complained of a sensation of extreme dryness in the throat during swallowing. There was an elevated temperature, the face was

cyanosed, feeble pulse and a paresis of the lower extremities. Inquiry showed that both patients had eaten raw ham as well as six others. All showed lack of accommodation; in four there was paralysis of the soft palate. They all made an uneventful recovery. The paralysis of the soft palate lasted fifteen days; lack of accommodation persisted for a considerably longer time.

The author discusses the resemblance of botulism to postdiphtheritic paralysis and makes the following differential diagnosis:

1. Accommodation and the pupillary sphincter are in botulism generally affected at the same time, if not to the same degree. In postdiphtheritic paralysis, on the contrary, the pupillary action remains intact.

2. External muscles of the eye are very rarely involved in postdiphtheritic paralysis. In botulism, on the other hand, it is not rare to see, apart from an internal ophthalmoplegia interna, a paralysis of the external muscles.

3. Paralysis of the eye appears often on the first day; more often, on the second or third day after the taking of the poisoning food. Postdiphtheritic paralysis appears much later; on the average, four weeks after the attack of diphtheria.

4. The duration of the paralysis from botulism exceeds in duration that of postdiphtheritic paralysis: "Four to eight weeks in case of diphtheria, five to eight months in paralysis of botulism."

In conclusion, the author refers to the similarity of the symptoms of botulism to those in atropin poisoning: Agittalon, dryness of the throat, notable diminution of the saliva, hallucination of the vision, dilatation of the pupil, but there never exists a paralysis of the external muscles of the eye in atropin poisoning. This symptom is peculiar to botulism.

Harris.

The Tonsil and Adenoid Situation in New York City. Report by the Public Health Committee of the New York Academy of Medicine.

Med. Rec., N. York, 1921—XCIX—845.

The present annual demand for tonsil and adenoid operations can be estimated as of over 55,000. The existing facilities when fully utilized can probably be made sufficient to meet this demand, but the number of operations performed in 1920 was 8,000 below the estimated demand.

There is need for a regulatory system to secure a more uniform distribution of patients among the hospitals and to reduce the excessively long waiting lists in some hospitals.

The standards of operative procedure, as well as the care of children, before and after tonsillectomy, differ considerably in the several hospitals. There is a need of stimulating the institutions to an appreciation of the importance of a thorough physical examination of the patients before operation and of provision for adequate care after operation, as well as for more effective methods of instruction as to care to be taken after the patients leave the hospital.

A longer period of pre- and post-operative care would reduce the number of cases which can be accommodated in hospitals, and an extension of facilities in certain directions or during certain periods of the year might, therefore, be required.

Emil Mayer.

Induced Atrophy of Hypertrophied Tonsils by Roentgen Ray.

Murphy, James B.; Witherbee, W. D.; Craig, S. L.; Hussey, R. G.,
and Sturm, Ernest.

J. Am. M. Ass., Chicago, 1921—LXXVL—228.

The factors governing the dose of Roentgen ray given in the region of each tonsil were as follows: The spark gap measured between points was 8 inches; 5 milliamperes; 10 inches distance from the target to the highest point of skin exposed. The time of exposure varied from three to seven minutes, according to the age of the patient. The ray was filtered through 3 mm. of aluminum. The approximate value of this dose was 1 to 1½ skin units. The patient to be treated was placed on a table in such a position that the ray entered under the angle of the jaw and penetrated through the soft tissues to the region of the tonsil. The area exposed on each side was about 3 square inches, the surrounding parts being protected by heavy sheet lead. For young children a special board was used with retaining straps, and the head secured by means of a gauze bandage.

In all but four cases the treatment was followed by marked improvement. In the majority of cases, two weeks after the exposure to the roentgen ray a distinct shrinkage of the tonsil was noted, this process continuing from one to two months. During this period of atrophy the crypts opened and drained, and, in all but a few cases the exudate disappeared from the throat, and the surface of the tonsils became smooth, pale and of a healthy appearance. With the exception of four cases, no exudate could be squeezed from the deep tonsillar tissue at the end of the period of observation. Later examination of the throat showed the edges of the crypts to be inverted, and in a number of cases white bands resembling scar tissue were noted on the surface.

The results reported here suggest the possibility of utilizing the well known fact that lymphoid tissue is easily destroyed by the roentgen ray for clearing the throat of an excess of this tissue. In the series reported above, only one patient received more than one treatment.

To judge by studies on animals, it should be possible to induce almost any degree of atrophy by repeating the roentgen ray treatments at suitable intervals. It is possible that the hypertrophied condition may return after a lapse of time; but with the mildness of the roentgen ray treatments recommended, there is no reason why it should not be repeated as often as desired, with the proper interval between exposures. The actual amount of roentgen ray used is smaller than that commonly used in the treatment of ringworm of the scalp, from which no bad results have been recorded.

The disappearance of the hemolytic organisms of the throat is attributed, not to the direct action of the Roentgen ray on these organisms, but rather to the proper drainage of the crypts as the tonsil tissue atrophies.

How practicable this treatment will prove can be determined only by the study of a large series of cases followed over a considerable interval of time.

Emil Mayer.

The Value of Vaccine Therapy Versus Tonsillectomy in Systemic Disease of Tonsillar Origin.

Hays, Harold; Palmer, Arthur, and Winslow, Thomas S.

Med. Rec., N. York, 1921—XCIX—304.

1. Systemic disease is often of tonsillar origin, even when the tonsils are small and show little evidence of disease.
2. Cultures from the tonsils should be taken in all cases of systemic disease.
3. Cultures taken from the tonsils, preferably from the supra-tonsillar fossa, showing any form of streptococcus, should be considered prima facie evidence of tonsillar disease sufficient for their removal, if associated with systemic disease.
4. Tonsillectomy is a better procedure than the administration of vaccines unless operation is contraindicated.
5. A poorly performed operation is no criterion of the value of tonsillectomy. A small piece of tonsil remaining may still keep up the systemic infection.
6. The value of the vaccine as a curative agent is yet to be proved.

Emil Mayer.

Studies of the Nasopharyngeal Secretions From Influenza Patients.

Olitsky, Peter K., and Gates, Frederick L.

J. Am. M. Ass., Chicago, 1921—LXXVI—641.

From the filtered nasopharyngeal washings, from early cases of uncomplicated epidemic influenza and from the lung tissues of experimental animals, we have cultivated minute bodies of characteristic morphology which are strictly anaerobic, are filtrable, and withstand glycerolization for a period of months. The effects on the blood and in the lungs of rabbits and guinea pigs injected with these bodies are similar to those produced by the filtered and unfiltered nasopharyngeal secretions from early cases of epidemic influenza.

Emil Mayer.

IV.—LARYNX, TRACHEA AND ESOPHAGUS.

Laryngeal Diphtheria. Review of Five Hundred and Fifteen Cases in Which Intubation Was Performed.

Hoyne, Archibald L.

J. Am. M. Ass., Chicago, 1921—LXXVI—1305.

There is probably no more difficult operation in surgery than an intubation properly performed. And whereas almost any one possessing a little surgical skill can make an incision in the neck and insert a tracheotomy tube, very few will succeed in their endeavors to intubate the larynx unless some experience has been acquired in this character of work.

Some of the remarkable results reported for intubated patients in private practice must be totally beyond the comprehension of any one possessing an extensive hospital experience in this type of disease.

Laryngeal diphtheria is the one type of disease in which the general practitioner is most inclined to give massive doses of antitoxin, and yet in cases in which the membrane is confined to the larynx such treatment is seldom required. These patients do not suffer extensively from a toxemia. The ordinary complications of diphtheria, such as the various forms of paralysis and nephritis, are not often encountered when the membrane is limited to the larynx. When death ensues, it is almost invariably due either to asphyxiation, as a result of mechanical obstruction by the membrane or to a complicating bronchopneumonia. From 15,000 to 20,000 units is usually a sufficiently large dose of antitoxin for cases in which the larynx alone is involved. If there are other sites of infection also, as the tonsils or nasopharynx, a considerably larger amount of antitoxin may be demanded.

The following factors may be summarized as having been contributory to the excellent results secured in this series of hospital cases:

1. Permanence of resident physicians.
2. Specially trained nurses, one of whom always has the patients under constant observation.
3. Emergency bell system.
4. An interval of four or five days before the tube is removed after intubation. This has reduced the number of reintubations necessary.
5. Thorough sterilization of instruments, thus lessening to some degree, at least, complicating bronchopneumonias.
6. Thorough cleansing of hands before and after each operation, a simple precaution, which, nevertheless, is often neglected in dealing with intubated patients.
7. The transfer of patients from the tube room as soon as this can be done with safety, thus lessening the chance of crossed infections.

Emil Mayer.

V.—MISCELLANEOUS.

The So-called Impassable Cicatricial Stenosis in the Esophagus in Infants.

Brindel.

Rev. de laryngol., d'otol., August 15, 1920.

During the present year Brindel has seen five cases of esophageal stenosis in infants. As a result of the study of these cases he is inclined to disagree with Guiseau in his view that the affection is a progressive one. He strongly favors the hypothesis of spasm. In favor of this is the facility with which one can dilate such a stenosis when he has succeeded in passing it for the first time. At the same sitting it is often possible to introduce ten or fifteen numbers of the bougie. If it were a case of purely fibrous stricture, in his opinion, it would not be possible to obtain so rapid a result.

In conclusion, particular emphasis is laid upon the value of the esophagoscope in causing the disappearance, in the great majority of cases, of impassable strictures.

Harris.

Roentgenographic Studies of Bronchiectasis and Lung Abscess After Direct Injection of Bismuth Mixture.

Lynah, Henry L., and Stewart, William H.

Ann. Surg., N. York, 1921—LXXVIII—3.

(1) Bismuth mixtures can be injected into the bronchi and lungs of a living patient without danger. (2) The injection of an opaque substance into the lung of the living patient will open an enormous field of usefulness in the study of cough, the expulsion of substances from the lung, and lung drainage. It will also aid in localizing bronchial strictures in the same manner as in the esophagus. Furthermore, it will be of the greatest aid to the thoracic surgeon by mapping out the abscess cavity in the respective lobe of the lung. (3) A definite lung abscess cavity is seldom seen bronchoscopically. Pus is usually seen coming from a branch bronchus, although the abscess may be well around the corner, and not in that portion of the lung from which the pus is oozing. An injection of bismuth mixture or some other opaque mixture will "clear up" this error. (4) Bismuth when it enters the abscess cavity is recognized by its metallic luster, whereas, when it is in the lobular lung structure it is discerned as a dull, opaque area. Pus diffuses and soaks the lobular structure in a manner similar to bismuth; this often makes the involved area appear many times larger than it really is. (5) The bismuth mixture injected in these patients was 8 cc. of bismuth subcarbonate in pure olive oil (1-2). The mixture is rendered sterile by boiling before injection. (6) The injection should be made slowly and not with a "squirt," or else the roentgenographic observations may be spoiled by bismuth soaking the lung structure surrounding the diseased area. (7) It seems from these preliminary studies that cough and action of cilia are not the only means of expelling secretions. (8) While bismuth mixtures were originally injected for the purpose of lung mapping in cases of lung abscess cavities, they seem to have been of therapeutic benefit to the five patients upon whom they were tried. So far the procedure has done no harm. (9) While the fluoroscopic examination is important, stereoroentgenographic examination is the best means of localizing the cavitations. (10) Experience has shown that the Roentgen examination should be made almost immediately after the removal of the bronchoscope, otherwise the patient, in a fit of coughing, will remove much of the bismuth from the involved lung.

Emil Mayer.

A Refinement in the Radical Operation for Trigeminal Neuralgia.

Frazier, Charles H.

J. Am. M. Ass., Chicago, 1921—LXXVI—107.

In every respect the results of the radical operation for trigeminal neuralgia are most satisfactory. With the exception of one death from apoplexy of a patient in the convalescent stage, there have been none in my clinic in the last 157 operations (0.6 per cent).

These are the major considerations. Of minor consideration is the "cosmetics." In times past the motor root has been sacrificed

with the sensory root, and there followed inevitably atrophy of the temporal, masseter and pterygoid muscles. So far as it affected movements of the jaw it was a matter of inconvenience; but the atrophy of the temporal muscle left a depression above the zygoma that was quite noticeable and prevented what otherwise might have been regarded as a perfect cosmetic result, since the incision was well concealed within the hair line. To meet this objection some surgeons went so far as to resect the zygoma.

In the past the motor root was often sacrificed because the surgeon was afraid he might be leaving a fasciculus of the sensory root with all its unfortunate possibilities. But with the use of the electrode the motor root when exposed can positively be identified as motor by observing the temporal muscle contact.

When the sensory root is adequately exposed, in the course of the operation, it is elevated from its bed with a blunt instrument. Usually the motor root may be seen in contact with the skull, traversing the space behind the root and disappearing behind the ganglion. If recognized or suspected, the electrode is applied; and should it prove to be the motor root, the fibers of the temporal muscle, exposed to view in the wound, will contract. Sometimes at this preliminary inspection the motor root will not be seen because, cleaving to the sensory root, it has been lifted up by the instrument with the sensory root. Under these circumstances I make segmental sections of the sensory root, beginning with the outer fasciculi, and search for the motor root after each section. Usually when half of the sensory root has been divided, one can recognize the motor root as it passes behind the ganglion. But to confirm the observation, the electrode is used. If these directions are followed, the motor root may be conserved in the majority of instances. It has escaped me occasionally, but with continued effort and experience, I believe it will be possible to save the root in every instance. With this refinement in technic the radical operation might be said to be beyond criticism. Symmetry of the face is conserved, as there is no atrophy of the temporal muscle; there is no deviation of the jaw, since the pterygoid muscles are intact; and mastication is in no way interfered with.

Emil Mayer.

The Mechanism of the Carrier State, With Special Reference to Carriers of Friedlander's Bacillus.

Bloomfield, Arthur L.

Bull. Johns Hopkins Hosp., 1921—XXXII—359.

Bloomfield found it possible to show, in the case of Friedlander bacillus carriers, that the breeding place of the bacteria is in a definite focus—the tonsil. From this point the organisms are discharged into the open pharyngeal cavity, and at times may be introduced into the nose. There is no evidence, however, to indicate that any adaptation takes place between the bacilli and the mucous surfaces. They react as the normal mucous membranes do, both surfaces, leading to actual growth and multiplication on these upon the introduction of the carrier's own strain, or the introduction of a second strain of Friedlander's bacillus.

Of the eighty-five unselected individuals studied in this investigation, 5.8 per cent were found to be carriers of Friedlander's bacillus. The carrier state persisted throughout the observation. There was no tendency for contacts to acquire the carrier state. Differential cultures showed the breeding place of the Friedlander bacilli to be in the tonsil. The carrier's own strain or a foreign strain of Friedlander bacillus implanted upon the free surfaces of the mucous membranes disappeared at the same rate of speed as in a noncarrier. It was impossible, artificially, to produce a carrier state by repeated inoculation with B. Friedlander. The general conclusion from these observations is that the carrier state depends on a focus of diseased tissue which affords a breeding place for the bacteria. They do not become adapted to growth on the free surfaces of the mucous membranes. Emil Mayer.

Pituitary Extract in Conjunction With Local Anesthesia.

Otrich, G. C.

J. Am. M. Ass., Chicago, 1921—LXXVL—591.

The writer uses a 2 per cent procain solution in combination with pituitary extract, 1 cc. of the obstetric strength, to 5 cc. of the procain solution. "When a larger amount is to be used, I use the surgical strength.

"My preference for pituitary extract to epinephrin is that the action is slower in taking effect and lasts much longer, which is proved by taking the blood pressure curve after the injection. The longer period of vasoconstruction gives a better chance for the organization of the clot. The slow passing effect and the slow returning to normal of the small vessels give the clot a better chance for further fibrination, thus holding more securely. In epinephrin the action is very rapid and the effect passes with the same rapidity. Therefore, sufficient time is not given for clot formation and fibrination. Furthermore, in the sudden relaxation of the walls of the small vessels and arterioles, the clot will be washed away and the secondary hemorrhage will take place, and it will be harder to control than the original."

Emil Mayer.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of January 3, 1921.

THE PRESIDENT, DR. ALFRED LEWY, IN THE CHAIR.

Teratoid Tumor of the Floor of the Mouth.

Dr. Otto J. Stein presented the specimen of a teratoid tumor on the floor of the mouth, which he had removed from a patient presented two months previously. Dr. Stein had been asked whether the condition was common or rare as seen by throat specialists. At the time this patient was presented he had seen only two cases but had since seen a third case, the specimen from which he also exhibited.

Dr. Norval H. Pierce presented a paper entitled,

"The Normal and Pathological Pneumatization of the Temporal Bone—A Review"* (With Lantern Slides).

DISCUSSION.

Dr. J. Holinger expressed himself as much interested in Wittmaack's book, which he had only recently received, and tendered his personal thanks to Dr. Pierce for having brought the work to the attention of the Society in this instructive manner. He believed that Wittmaack found well prepared ground in the work of Preysing on the otitis of the newborn. Nevertheless he felt that the work of Wittmaack showed great originality and a very great fascination in its diction. Still he hoped that Dr. Pierce would not expect that all was accepted without criticism.

In the chapter on cholesteatoma, he found that Wittmaack explained that cholesteatoma may form in ears where no suppuration or inflammation had ever occurred. In looking over his own publications Dr. Holinger found that in 1901 he had stated in an article on "Varieties of Cholesteatoma" (read before the Chicago Pathological Society) "Suppuration of the middle ear need not have preceded and yet we have epidermis in the middle ear and cholesteatoma." Ten years ago in a paper on "The Pathology and Prognosis of Internal Ear Complications Resulting from Inflammatory Middle Ear Diseases," he had stated, "It may also occur without even a trace of inflammation or suppuration or granulation being present."

As to the progress of cholesteatoma towards the interior of the skull cavity, the embryonal communications discovered by Wittmaack certainly do not form the only route. The absorption of

*See page 509.

bone and consequent disappearance of the walls, as Dr. Holinger had observed, often result in a spreading of the cholesteatoma through perfectly normal bone. The absorption of healthy bone is a process which is general in the cholesteatoma cavities. Dr. Holinger has at least two microscopical specimens of walls of cholesteatoma in which there is no trace of underlying embryonal tissue and where the epidermis is practically on the bone with no more than one layer of subepithelial tissue between it and the bone. Absorption of bone in Howship's lacunae goes on directly under the epidermis, and the epidermis on one place forms a bridge over a Howship's lacuna.

Other points in the course of development of cholesteatoma will be difficult to explain on the basis of faulty pneumatization. Take for example the following cases: A man was 36 years old when first seen. Dr. Holinger observed him for more than ten years. Owing to the fact that the patient could not come regularly for treatment of a very stubborn occlusion of the eustachian tube, the drum-head became more and more retracted. At first it was easy to bring the membrane back to normal, later on hard, then impossible. The retraction was so bad that a regular cholesteatoma formed. It was necessary to perform a radical operation within five years and large masses of cholesteatomous material were found in the antrum. If the man had remnants of embryonal tissue in the antrum and middle ear all the time, why did he have to wait until he was 36 years old before retraction of the membrane began, which finally led to the development of the cholesteatoma after the age of 40?

Furthermore, on December 1st Dr. Holinger read a paper before the Chicago Medical Society on "Perforations of the Drum Membrane," and showed a boy suffering from occlusion of the eustachian tube and retraction of the membrane. The posterior portion of the membrane was deeply drawn up into the antrum but it came back each time after inflation. In that case he could show the cause for the occlusions of the eustachian tube, a scar, perpendicular to the axis of the opening of the eustachian tube, could be seen through the pharyngoscope. This scar distinctly stenosed the eustachian tube. There the process was caused by a visible agent, which produced the occlusion of the tube. So far as he could see, there was no reason to suspect abnormal conditions of the lining membranes of the middle ear or adhesions which form an occlusion of the drum cavity from the upper cavity an antrum. An X-ray picture of the mastoid of this patient showed good pneumatization. So this could not be the cause of the disease. The explanation of this case is clear: In removing the adenoids, the surgeon had injured the orifice of the eustachian tube and the beginning cholesteatoma is the consequence of the stenosis of the tube. The persistent embryonal tissue and incomplete pneumatization is certainly not the cause of every cholesteatoma.

Dr. Joseph C. Beck said that he was at a disadvantage because he had not seen the book of Wittmaack, but he wished to join Dr. Holinger in expressing his appreciation of Dr. Pierce's excellent presentation of a most difficult subject. He was inclined to think that it almost hurt Prof. Siebenmann and a criticism of Witt-

maack's work by the professor shortly after its publication was brought out in the leading German journal devoted to otolaryngology, which Dr. Beck had read with great interest. He was sure everyone appreciated the pioneer work of Prof. Siebenmann in otosclerosis and yet were interested in the heated discussions between Siebenmann and Manasse and the former's opposition to Manasse's opinions on otosclerosis, and Manasse has many adherents at present. He had seen Wittmaack in Europe, as a student, and had then the impression that he did not know much more than the others, but his work that had been shown by Dr. Pierce as well as other studies formerly brought out, promised for Wittmaack big things, especially so from the pathologic point of view in such diseases which had not been relieved by previous treatments, as for instance, adhesive processes of the middle ear. The sad part in Wittmaack's work as presented by Dr. Pierce was the inability to prevent this infant spongifying process in the ear. This last work of Wittmaack's was a stimulation for Dr. Beck to go over his microscopic specimens of infant and children mastoid chips again and take, what he thought, from a histologic point of view, to be exudate in the mastoid cells and see if it was not this embryonal tissue which he had probably not stained as carefully as Wittmaack. He intended to study such specimens again and hoped to have the privilege of bringing them before the Society again and emphasizing the points brought out by Dr. Pierce.

Dr. Beck thought he could speak of between 500 and 2000 X-ray pictures of the mastoid taken stereoscopically in regard to pneumatization. These were made in all possible conditions in children, and he was sure that if pneumatization had been inhibited as mentioned by Dr. Pierce, the percentage was too high, because most of the radiograms examined up to five years have been found to have large pneumatized mastoids, usually present on both sides. Many of the children had conditions due to otitis media and adenoids, which should have arrested the pneumatization as stated by Dr. Pierce. If the arrest was due to such tissue changes, why would it not stop pneumatization sooner. In his opinion, the percentage stated to exist was too high.

Another point was the pneumatization of the adult mastoid. The speaker had studied the large pneumatization mastoids and found them having the dumb-bell contraction in and about the antrum mastoidei which was usually diplöic in character. If pneumatization occurred as it was shown by Dr. Pierce from the antrum outwards, how did the pneumatization take place peripherally as can be shown in the X-ray or account for the repneumatization of the pathological mastoid, that is, a mastoid acutely infected and subsequently undergoing resolution? Dr. Beck had a series of X-ray pictures of a physician who had an otitis media with mastoid symptoms and the pictures were taken ad seriatim, showing obliteration of the mastoid as the disease progressed. The patient recovered completely without operation, his drum membrane subsequently showed nothing of the previously existing nipple perforation and the mastoid cells were completely repneumatized. Whether or not there were any microscopic remains of the pathological process Dr. Beck did not know.

The speaker felt that Dr. Pierce should have the thanks of the Society for bringing the work before them and was convinced that the translation of Wittmaack's work would be of value because it was something in the hope of a new era for otology.

Dr. Alfred Lewy thought that in so widespread an affair as was described by Dr. Wittmaack, especially as it was commonly bilateral, one would think of a failure of development, due to some systemic rather than local process; for instance, failure of some internal secretion. We all know that bony changes can be brought about by pituitary disease. If this disease is found in so high a percentage of sucklings as is claimed by Wittmaack, one would naturally expect a much higher percentage of deafness in children. Of course, our observation of disturbance of hearing in children from causes in fetal life is very inadequate, so Wittmaack's statement, if correct, will explain many cases of deafness in which no inflammatory action has been noticed.

Dr. Lewy asked if any specialized epithelial cell on the order of an osteoblast had been described as causing the erosion or pneumatic spaces. He had found no mention of it in the book.

Dr. Norval H. Pierce (closing the discussion) stated that Wittmaack was especially careful to say that the process he described had nothing to do with otosclerosis. In all his studies he found nothing that bordered on otosclerosis. Otosclerosis occurs in bones that are completely pneumatized, without any changes in the recessus. He thought there seemed to be a great discrepancy between the cases of deafness that occur in adult life and the incidence of otitis media of infants or sucklings. When it was considered that good observers believe that 90 per cent. of infants during the first two years of life have this form of otitis media, it would seem that there would be more cases of deafness and cholesteatomatous formation. However, Zuckerkandl, in his study of 268 cases of adult mastoids, found only 26 per cent. of cases that were perfectly pneumatized, so there was a certain agreement there. A study of the vital statistics might be of some interest and assistance, in determining how many children with this disease were really growing to adult life. Wittmaack admits this discrepancy and did not attempt to explain it, but left it to future developments.

Dr. Pierce thought it seemed a bit fatalistic to say that this condition, occurring in infancy, stamped the individual's auditory fate for life, but if it was true there was no help for it. The matter is not, however, as pessimistic as it would seem. It meant that certain problems must be attacked that had not been attacked so far. If the amniotic fluid found its way into the ear, did that constitute a foreign body? Dr. Pierce thought that it did. It was not normally found in the eustachian tube; that is a closed tube and fluid cannot get into it in fetal life except when the fetus makes extraordinary efforts in swallowing. If it was a normal content of the cavum then that hypothesis would fall down.

Another very practical point in prophylaxis was the proper mode of accouchement. At present the obstetrician holds the head back to save the perineum. They delay labor by anesthetizing the highly developed mother and that might to a certain extent be the cause of the incidence of the condition. All these things must be

thought of and prevented or disproved. In the opinion of Dr. Pierce, the book of Wittmaack is a colossal work and he felt that it was largely founded on facts. The occlusion of the tube must be proven or disproven. Dr. Lewy had taken all the joy out of life by saying the thing might be due to the pituitary body, but that also would have to be proven. Wittmaack had not spoken especially of osteoblasts in dealing with the subject.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of February 7, 1921.

THE PRESIDENT, DR. ALFRED LEWY, IN THE CHAIR.

"Fibroma of the Soft Palate"

Dr. George M. McBean presented a patient with a swelling in the right side of the soft palate. There was no complication of any kind, no pain and no history was obtainable. The patient was in the army a couple of years ago and at that time was told he had a large right tonsil. Dr. McBean had put a needle into the growth recently but obtained no fluid. He believed it to be a fibroma of the soft palate.

DISCUSSION.

Dr. George E. Shambaugh stated that the situation did not look unlike a type of large tonsil which one occasionally encounters, in which the enlargement is for the most part upward between the folds of the soft palate. The enlargement was more exaggerated in this case than he had ever seen from a tonsil. He recalled a case where this type of enlargement of the tonsil existed on both sides in a patient who suffered a great deal from frequent attacks of acute tonsillitis. Tonsils were removed under local anesthesia which was not an easy undertaking. The operation was followed by more or less paralysis of the soft palate resembling the situation observed after diphtheria. The annoyance from fluid getting up into the nose when the patient attempted to swallow persisted a number of weeks. The end results were entirely satisfactory.

Dr. Joseph C. Beck was reminded of two cases, one of which proved to be a calculus (amigdolyth). The case presented much the same appearance as Dr. McBean's but upon opening the supratonsillar fossa he found a mass larger than a small hazlenut, which was made up of a concretion like a stone.

The second case had been seen about two weeks previously and had a growth coming over from the posterior lateral wall. The case was referred to as a sarcoma. Upon exposing the tumor for microscopic examination they found a definite capsule. A piece of the capsule was excised and found to be quite dense, below which there was a soft tissue, and upon sectioning the tissue it was found to be lipomatous.

Extradural Abscess and Sinus Thrombosis.

Dr. Samuel Salinger presented a pathologic specimen from a case of extradural abscess and extensive sinus thrombosis. He had removed a large clot extending from the knee to the bulb and tied the jugular. The boy got along well for a week, but the jugular wound became infected with what proved to be a diph-

theroid organism. On the tenth day the dressings over the neck wound were found to be saturated with blood. The patient was put on the operating table and removal of the dressings was followed by an enormous gush of blood. The common carotid was tied but the patient expired shortly afterward. The specimen presented showed an erosion of the common carotid from without about the size of a small pea. Dr. Salinger was not sure whether the rupture was due to infection, to the rubbing of the ligature on the artery, or whether Dakin's solution, with which the wound had been irrigated, had anything to do with it. He asked for an expression of opinion.

DISCUSSION.

Dr. J. Holinger stated that he read a paper a year ago on sinus thrombosis and mentioned the report of a case in which the erosion of the carotid artery by the ligature on the jugular vein caused the death of the patient. There is no way of avoiding such accidents after ligature of the vein because the artery and vein are so close together in the same sheath. The movement of the pulsating artery will produce erosion.

Dr. Joseph C. Beck did not agree with Dr. Holinger as to the cause of the rupture. He had seen a similar rupture in a case of suspected carcinoma, which, however, was a healed out Bezold abscess. In that case they made a complete dissection of the common carotid, both external and internal, and the jugular vein. These were protected with dressings and the next day upon dressing the patient, who was a physician, they found an enormous bullae formation over the side of the neck. Upon puncturing these bullae they found a pure culture of a diplococcus. The wound was left exposed for subsequent X-ray treatment and in four or five days they found a small white spot on the external portion of the carotid artery. The next day it was slightly larger, with a little bulging, and on the sixth or seventh day they were compelled to do a temporary compression of the common carotid, thinking that by reducing the amount of blood going through they would get a granulation of the wall of the artery. On the same day Dr. Pollock was called in a hurry because the patient had a sudden gush of blood from the neck wound and he succeeded in grasping the bleeding point with an artery forcep. In the afternoon they made a complete ligation with tape and were able to take off the artery forceps, as there was no bleeding. The patient developed a hemiplegia during the night and died two or three days later. They should not have made the dissection, but the case was sent in as carcinoma. Subsequent examination showed that it was simply inflammatory, and the patient had carried the infection around for years.

In his opinion the case reported by Dr. Salinger was a similar one, the organism producing an arteritis from the exterior and causing a rupture. If it had been exposed earlier and tied they might have been able to save the patient.

Dr. Salinger (closing the discussion) said he did not think the ligature had eroded the artery by friction in this case. The erosion was not directly opposite the ligature and in his opinion it was

due rather to infection from the exterior. He had seen one case where carcinoma had eroded the common carotid, and another similar to the one reported by Dr. Beck, but this was the first case of this kind that had come to his notice.

Bead in the Bronchus.

Dr. George W. Boot reported a case of a small boy who had been left in his father's care and was taken with a severe coughing spell. The father did not know what the child had inhaled, but supposed it was a bead, as a broken string of beads varying in size was found. Roentgen examination show nothing, as the bead was transparent to X-rays. Upon listening to the child's chest the bead could be heard flying up and down the trachea with each inspiration and expiration. Dr. Boot did upper bronchoscopy and tried to get the bead but the forceps would not hold it and in the effort to grasp it the bead was pushed into the left bronchus where it was firmly lodged. It was smooth and hard and forceps always slipped off. A probe could not be insinuated past it. He finally evolved the instrument which he presented for inspection. The problem was to have an instrument small enough to pass through a small bronchoscopic tube and yet permit enough light to pass so that the instrument could be passed into the hole in the bead under direct visual guidance and at the same time hold firmly enough to dislodge the bead. With this little appliance which V. Mueller and Company made for him, he was able to remove the bead.

Dr. Clark W. Hawley (by invitation) presented a paper entitled "**Abnormalities of the Mastoid in Reference to the Facial Nerve,**" and exhibited specimens of the temporal bone showing anomalies of the nerve.

A number of specimens were shown showing the abnormal position of the lateral sinus.

Also two specimens where the facial nerve passed down the center of the mastoid bone instead of in the base of the posterior wall of the ear. The nerves were situated in the path of the operation and would be injured unless the operator was on the lookout for the malposition. Such abnormalities may account for some of the facial paralyses that occur. The knowledge of their occurrence will be useful to the expert witness in malpractice cases.

DISCUSSION.

Dr. George E. Shambaugh stated that it was not easy to judge of the exact relation of the facial nerve to the surrounding parts by a dissection of this sort that works in from the surface. Students who are attempting to visualize the anatomic relations of the temporal bone do not accomplish this successfully by performing the operation on the mastoid and observing the relations as they are uncovered in the course of this procedure. The reason for this is that one important relation after another is destroyed in making an opening into the mastoid. It is necessary to make a series of anatomic sections, each one devised to bring out an important anatomic relation in order to study definitely the exact relation of the facial nerve as it courses through the temporal bone. The best

type of preparation is made by a section which passes through the tympanum in the perpendicular plane and lays open the facial canal from the point where it turns downward just in front of the horizontal semicircular canal until it leaves the stylomastoid opening. A section made in this way leaves no chance for deception in measuring the relation of the facial canal. The impression Dr. Shambaugh gathered from an examination of the preparations presented was, that the facial nerve was entirely in its normal position. He has seen only one anomalous variation in the course of the facial nerve. This was in the preparation exhibited by Dr. Behrens.

There are several facts in connection with the course of the facial nerve that should always be kept in mind when operating on the temporal bone: First, that the nerve enters the tympanum in front and above the oval window. Second, the relation which the nerve bears to the posterior wall of the exterior auditory meatus. This relation at the upper part of the tympanum is quite different from what it is at the floor of the tympanum. In the former location the nerve lies close to the posterior wall of the tympanum and on a level with the inner wall of this cavity. As the nerve runs downward toward the stylomastoid opening, two alterations take place in relation to the tympanum. The first is, that it lies farther and farther away from the posterior wall of this cavity until it reaches the floor of the tympanum. At this point it is separated usually by one-quarter inch from the tympanum cavity. The second alteration is that as the canal extends downward from the knee instead of lying at a depth parallel with the inner wall of the tympanum, it extends out farther and farther along the postmeatal wall. This latter fact has been responsible for injury to the facial nerve when operators have attempted to flatten out the posterior wall of the meatus.

Dr. Joseph C. Beck stated that his purpose in asking Dr. Hawley to present this subject before the Society was that thus far there was only one specimen, to which Dr. Shambaugh had referred, and it occurred to him in mentioning this fact not less than eight times as a witness in defending a physician against malpractice suits, by bringing this fact to the attention of the judge and jury and having it save the doctor in summing up the evidence, that if it could occur once it might occur again, and this case of Dr. Hawley's was probably one of those cases. When Dr. Hawley showed Dr. Beck the specimens he had the same impression that Dr. Shambaugh had—that the facial canals were no different from others he had seen. When one considered Cheate's collection of temporal bones and remembered that in not a single case was there a repetition of the specimen shown by Dr. Behrens, one realized that the course of the facial nerve was very definite and constant and in the course of an ordinary mastoid operation this injury does not occur. Dr. Beck wished there was another case on record like Dr. Behrens' because one case was not enough.

Dr. Beck added one point to those brought out by Dr. Shambaugh: That the facial nerve does not extend external to the prominence of the horizontal semicircular canal, and if one keeps external to that when taking off the posterior lower wall there will

not be much trouble. This point had helped him greatly. They very seldom had any facial paralysis, but it does occasionally occur in the hands of the best operators.

Dr. Hawley had not yet proven the point that he made when he showed the same specimens at the Illinois State meeting. Dr. Beck had expected him to make sections and cross sections of the specimens and present them in detail, but this unfortunately had not been done.

Dr. J. Holinger said the question of the course of the facial nerve was especially important when in a case of Bezold's mastoiditis, the cell causing the perforation into the neck is to be sought. This cell was often very deep, and unless it be drained, the operation could not be considered completed. Dr. Holinger thought that one could never see too much of the individual variations of the anatomy of these parts.

Dr. George W. Boot agreed with Dr. Shambaugh that the upper part of the nerve was very definite in its course. The lower part always emerges at the stylomastoid foramen. If these two points are connected a pretty good idea of the course the nerve runs with respect to the parts operated on can be had. At birth the nerve emerges on the outer surface of the temporal bone for the mastoid apophysis has not yet been formed. The reason the course of the nerve seems to vary is because of the varying amount of development of the mastoid apophysis. Its relation to the drum membrane and middle ear is quite constant.

Dr. Clark W. Hawley said he never had a discussion of any kind without somebody getting up and questioning the truth of what they saw. He believed that if Dr. Shambaugh had carefully examined the specimens he would have recognized that the nerve in the specimen, which had not been disturbed at all, was not in the posterior wall but ran down almost exactly on the center of the canal. In the one it was two-thirds away from the posterior wall of the ear. If he had not put the paint in he thought it would be a little more evident, but he had thought the paint would bring it out better. He had made three hundred dissections and had never found another case like these, although they did the radical dissection on all of them, and they had not touched the facial nerve at any time. On the specimens he had presented the nerve was very plainly shown. In teaching he always shows the students the course of the nerve as it travels in the petrous portion and also in the mastoid. He had found one or two instances where the facial nerve did not travel as Dr. Shambaugh had said and anyone who attempted to scrape away granulations from the mastoid antrum would have injured the nerve, for it did not go along the base of the middle ear but at the upper portion. It must also be remembered that the specimens were not intended to demonstrate the anatomic relation, but simply to show the students how to do a mastoid operation. In the specimens both posterior walls were preserved and the mastoid tip was not disturbed at all. Dr. Hawley thought that if these nerves were not displaced he would certainly have found the same position in many of the other operations done on the cadaver.

Dr. Howard C. Ballenger read a paper on

"Acute Hemorrhagic Otitis Media."*

DISCUSSION.

Dr. George W. Boot stated that when he saw the child whose case was reported by Dr. Ballenger, Dr. Ballenger favored operation while Dr. Boot opposed it. The following day he reluctantly gave his consent and had the child sent to the hospital because Dr. Ballenger could not be reached. Before the following morning set for the operation the child apparently had improved so no operation was done and the patient was returned to Dr. Ballenger's care. In another case Dr. Boot had operated on a man of 80 years under local anesthesia because of a streptococcus infection in a patient who had chronic interstitial nephritis. The mastoid cells were found filled with clotted blood. Unfortunately the patient developed facial erysipelas on the side of the wound. This cleared up only to be followed by erysipelas on the opposite side and this in turn by erysipelas of the leg with multiple abscess formation and the patient finally died of the erysipelatous infection.

Dr. Samuel Salinger thought it would be interesting to know in what condition the mastoid cells were found—whether there was a hemorrhagic mastoiditis as well, and also the condition of the bone.

Dr. Harry L. Pollock said that during the epidemic last year they had several cases in which there was bleeding from the ear. The examination of patients who came in with pain, swelling and redness of the membrane showed on close inspection with the otoscope that this appeared in the form of a blister. They had severe pain and temperature and in opening these blisters they got a bloody exudate which persisted for several days. Dr. Pollock's little son had a light attack of grip and about ten days later suddenly developed an earache and within a few minutes his ear drum was apparently bulging. This condition persisted for two days. Dr. Beck saw the patient and opposed doing a paracentesis. The thing ruptured spontaneously during the night and there was a discharge of bloody serum for several days, but there was no perforation in the middle ear. In none of the cases did they find it necessary to do any mastoid operation or paracentesis. Several of the cases looked like a mastoiditis, but after a few days the symptoms subsided very rapidly. One lady, who had a most excruciating pain for twenty-four hours, had complete relief from the pain when the little bleb ruptured, but the discharge continued. Had they performed a paracentesis they might have set up an otitis media, as there was pain all over the side of the head.

Dr. Pollock pointed out that Dr. Ballenger had not mentioned the X-ray pictures. If X-ray pictures were taken in these cases no mastoid involvement would have been shown.

As to indications for operating on the mastoid, the principal one was the hearing and in these cases, while the hearing was affected it was not so markedly as in the mastoid with involvement of the

*See page 539.

middle ear. The hearing recovered very quickly. In the otitis media cases, if the picture showed the mastoid to be cloudy, and they waited several days and then took another in order to see whether the condition was breaking down or clearing up, was one indication. If the hearing continued to grow less acute it was an indication to do a mastoid operation.

In their cases all the organisms found were streptococci.

Dr. J. Holinger asked whether in the case of hemorrhagic nephritis any carbolated glycerin had been used as eardrops. He knew that several cases of hemorrhagic nephritis had been reported in which carbolated glycerin had been used. In his practice he never advised the use of carbolated glycerin.

Dr. Harry Kahn said the subject was discussed in Pollitzer's book rather fully. The whispered voice test was a differential test between the myringitis and an abscess of the middle ear. In the epidemic last year many of these cases of sudden onset ruptured in a short time and hemorrhage from the ear was met with in many of the cases. He thought that this was nothing unusual in an influenzal epidemic, and that nothing new had been brought out. So far as he knew all the cases were of streptococcal origin and were probably entirely due to the influenza.

Dr. Robert Sonnenschein felt that even with very slight exudate in the middle ear, as proven by a paracentesis afterward, the hearing for the whispered voice was often as good as two or three meters for the high tones.

In reference to the differential diagnosis between an otitis media and a myringitis, aside from the other tests there are the tuning fork tests. While the Weber reaction is often unreliable, still in the case of an otitis media it is usually lateralized to the affected side, not so where a simple myringitis is present. The Rinne is usually negative with middle ear involvement and is usually positive in myringitis.

Dr. Joseph C. Beck thought that Dr. Ballenger's paper was very opportune. The point he brought out, which should be remembered, was not to operate on many of these cases. In the epidemics of the last couple of years they had seen quite a large number of such cases that had been operated upon less on the mastoid than on the drum membrane—a repeated sticking of the drum. In one case the ear had been jabbed fourteen times by an otologist in this city (not much of an otologist). The patient would not submit to further paracentesis and recovered simply when the ear was left alone.

As to the lateralization, they made the test and it did lateralize to that side where one found these blood blisters. There was no history of this. The Weber does lateralize and he thought Dr. Sonnenschein was mistaken.

Dr. Alfred Lewy thought an important point in Dr. Ballenger's paper was that apparently the less manipulation aside from paracentesis, in these cases, the better they got along. He also called attention to the fact that Dr. Ballenger's cases had marked mastoid tenderness, as well as persistent bleeding and later purulent discharge, so they were evidently not merely myringitis. He remembered reading a report by an Eastern otologist who boasted

that out of one hundred middle ear suppurations he only had thirty mastoids. Compared to this man, Dr. Ballenger would certainly classify as a conservative, and his results appear to justify his position.

Dr. Lewy had recently had an interesting experience with an early mastoid operation. He was generally opposed to operating within so short a time from the onset, but this child developed suddenly a swelling mostly in the zygomatic area which extended over the face. The patient had had measles six weeks previously, with an occasional earache since, without discharge, but had apparently been well two weeks when the swelling referred to suddenly appeared. The drum membrane was thickened, there was no discharge and no sinking in of the canal wall. There was headache, temperature over 102° and a white cell count of 12,000. Paracentesis was done, resulting in bloody discharge which became purulent within a few hours, but after two days no relief of symptoms. X-ray showed a clouding of the mastoid area, but no definite breaking down of cell walls. With pain, tenderness, swelling and a history of a possible six weeks' infection, dating back to the measles, instead of a four day affair, it was decided to do the mastoid operation. The cortex was found unaltered, but the region of the antrum and the tip cell were softened so that the curette alone was sufficient. White cell count ordered before the operation for some reason was not done until three hours afterward, and was 27,000, which suggests that in doing the operation for the purpose of establishing drainage, we are at the same time opening up avenues of extension for the infection. This always happens to a greater or less degree, but Dr. Lewy believes that there is a greater probability of such spread in early operation before nature has had time to establish her defenses.

Dr. Ballenger (closing) said that in this series it was necessary to operate on only two cases and they were done for the persistent otorrhea. Both mastoids were broken down. The cases that he knew about which were operated early showed a blood filled or negative mastoid. Most of these cases had mastoid tenderness to some degree, usually rather severe, and there was great prostration. The X-ray examination was not made in any of these cases in early stages as the patients were too sick to go to the hospital, but where the radiograph was taken later, after the formation of the pus, the shadows were dark.

In reply to Dr. Holinger's question, in regard to carbolated glycerin, he did not believe the carbolated glycerin would cause hemorrhagic nephritis before rupture or incision of the ear drum. Drs. Wall and Aldrich saw the case with the bloody urine and made the diagnosis of hemorrhagic nephritis.

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